

Encouragement of Arts, Manufactures
and Commerce, June 17, 1767.

MEMOIRS

OF

AGRICULTURE, &c.

RESOLUTION of the Society for the
Encouragement of Arts, Manufactures,
and Commerce, June 17, 1767.

*“ The Society for the Encouragement of Arts,
“ Manufactures, and Commerce, will occa-
“ sionally publish in this Work, such Pieces
“ as they shall think proper to lay before the
“ Public.”*

N. B. Those Gentlemen, who are disposed to favour the
Editor with any communications, respecting improve-
ments in Agriculture, or other useful matters, are request-
ed to send them to Mr. NOURSE, Bookseller to His
MAJESTY, in order to their being inserted in the
THIRD VOLUME.

1796.
M E M O I R S

O F

AGRICULTURE,

AND OTHER

OECONOMICAL ARTS.

BY

ROBERT DOSSIE, Esq.

VOLUME II.



L O N D O N,

Printed for J. NOURSE, Bookseller to, His MAJESTY.

MDCCLXXI.

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M E M O I R S

O F

AGRICULTURE

AND OTHER

RECORDS AND ARTS

Jos. Banks

ROBERT DOSSIER, ED.

VOLUME II

L O N D O N

Printed for J. Noakes, Bookseller, in the Strand



LORD ROMNEY.

MY LORD,

REASONS, too obvious for discussion, indicated the propriety of addressing to the King, the most eminent patron of useful as well as ornamental Arts, the First Volume of this Work: a principal view of which is, the promulgation of improvements in those Arts; and, particularly, of such as

may be produced by the Society instituted, at London, for the Encouragement of them. — Reasons of a similar nature point out the fitness of dedicating the Second Volume to Your LORDSHIP, the PRESIDENT of that Society: to whom, moreover, it owes, in a great measure, its original establishment, and the duration of its flourishing state. — It would have been a faulty neglect, not to have embraced this opportunity of acknowledging the high obligation, which every member of the British community, as well as of that body, lies under to Your LORDSHIP, for the very munificent offer of provisional assistance, which yourself, and your noble relation, Lord FOLKSTONE, the late President, at your instance, made for the maintenance of its funds, at the first

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commencement of the undertaking; and for your constant attendance, during so many years, whenever resident here, on the chair: in which you have always exercised the most benign temper, unbiassed judgment, and patient attention.

—This obligation of the Public to Your LORDSHIP is much enhanced, by the striking example, you have set to others, possessed of great rank and fortune, of making those advantages subservient to the public welfare, at a period, when the dissipation of pleasures, and amusements; or the sole engagements of self-interest, ambition, or party-spirit; have taken place of nearly all regard for more solid, liberal, or generous concerns.

The goodness of Your LORDSHIP's intention, in your endeavours to sup-

port the Society, and promote its designs, must of course be manifest to all, who are informed of these facts: tho' the fruits of it, with respect to the benefits, that have actually accrued to the public, are adequately conceived by very few; and greatly under-rated by most. But whoever will take the trouble, to examine the history of the proceedings of the Society, inserted in the First Volume of these Memoirs, will be fully convinced, that the number, and importance of the objects of pursuit, as well as the success in the attainment of the ends, are greatly beyond what could be imagined by those, who are unacquainted with the particulars.

As the spirit of this work is to emulate Your LORDSHIP's conduct, and to
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lend an aid, that was much wanted, to these endeavours for the public service, I hope for your approbation of the pains I have taken, in the faithful and correct publication of the papers, which the Society have done me the honour to intrust to my care:--in the explanations, and comments, I have annexed, to render those papers more intelligible and useful:--in the accounts, I have given, of some other momentous articles; of which, though communications relating to them had been made to the Society, there were no records, in a state proper to be published;--and in the original pieces, I have added condu-
cively to the same purposes.—If I obtain that approbation, I shall esteem it a reward for the performance of a task, attended with more difficulties, and em-
barrassments,

barrassments, than those, who are unapprised of the agitations of bodies composed of numbers of persons of different humours, and notions, can well comprehend; and which none would submit to encounter, who were not actuated with some degree of the same zeal for this meritorious cause, that so eminently inspires, and distinguishes Your LORDSHIP.

I am, my LORD,

with the greatest respect,

Your LORDSHIP's most obedient

humble servant,

ROBERT DOSSIE.

P R E F A C E.

AN earlier publication of this Second Volume of the MEMOIRS OF AGRICULTURE, &c. was announced at the time the First was completed: but some unforeseen accidents have rendered a delay of it unavoidable to the present. — The same circumstances, which have caused this delay, have produced, also, some variation in the proposed contents.—It was designed, according to a former declaration, to have continued the history of the proceedings of the *Society for the Encouragement of Arts, Manufactures, and Commerce*, with proper illustrative comments, in each succeeding volume: but after waiting, as long as expedience would admit, for the removal of some obstacles, it was found impracticable with respect to the present.—An alteration, made, by the Society, in the mode of publishing the annual account of premiums and bounties, given by them, occasioned an omission of any such account in their Premium-book of 1769: and the illness, and death of
their

their secretary, in that year, prevented the respective list from being made out afterwards till late in the present year. This threw a temporary difficulty in the way of going on with that history then: for there would have been an impropriety, in not taking the same groundwork of authority for the principal matters; which had been before used in the other part. In the mean time, the accumulation of papers, the Society had resolved to communicate to the world, rendered it unfit to defer the publication of them any longer: and this volume was, therefore, formed without that intended part of its contents.

The continuation of the history of the Society from the year 1767, where it terminates in the First Volume, to the end of the year 1770, with the explanations, and illustrations, as promised in the preface of the First Volume, will be given in a Third: which will be published as soon as conveniently may be, after it is determined, what pieces the Society shall, during the next term of their meetings, think proper to impart to the public.

The contents of this volume are, nevertheless, of so various, and interesting a nature, that it is hoped, they may well compensate for the

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the omission of that part of what was originally designed to have had a place amongst them: and some very important articles will be more seasonably published than they would have been, had the delay, and vacancy for them, not happened from the above-mentioned incidents.

It may be right to take notice of a circumstance, that might, perhaps, otherwise be thought to depreciate a part of what is here offered to the public, if it were left unaccounted for.—Some of the communications to the Society, which are inserted in this volume, have before appeared in print, alone, or in some miscellaneous compilements; and, consequently, may be deemed by some less novel, and original than what is expected to be found here. But, exclusively of the account of rearing and fattening hogs, by Mr. YOUNG, who had the Society's permission to publish it, the rest of the pieces so published, except one, were surreptitiously obtained by the editors; and all of them printed, not only without permission; but, for the most part, in such a faulty, and incorrect manner, as renders them of little value to the public; and must disparage so liberal a body as the Society, if they were supposed to have passed through their hands.—

Notwithstanding, therefore, this seeming anticipation, I considered it, as necessary to the acquitting myself fully of my engagements to the Society, to insert all they sent to me: as their obvious intention, in the Resolution "to publish in
" this work, such pieces, as they shall think proper to lay before the public," was, to have the whole of the information, they should deem it fit to impart, conveyed to the world in a faithful and authentic manner; and preserved in some one known repository, where it might always be found by those, for whose use it was designed.—It may be proper to add, also, that the Society have never, as a body, given the least sanction to any other work of a similar nature to this: notwithstanding whatever may seem to have the appearance of it, in some late proposals, and advertisements for the publishing such a work.

The importance of the subject of those articles, composing this volume, which are not published as communications from the Society, is too apparent, to leave occasion for any apology for them in that light; and they are studiously treated with as much brevity and perspicuity, as the nature of what constitutes them will, advantageously permit,

There is one, however, which takes up a considerable share of room, that may require some notice, to shew, that it is not an exception to this pretension: I mean the Dissertation on the Murrain of Cattle.—No-body will, I presume, deny the very momentous relation, which a general knowledge of that disease, and the means of the prevention, or cure of it, have to the interest of agriculture in particular, as well as to that of the public in a more extensive view: but it may possibly be objected, that I have treated of it, as to some points, in too abstracted and learned a manner for common readers of works of this kind —To such a charge, I plead thus in excuse:—There are several doctrines advanced in that Dissertation, both with respect to the nature and treatment of the disease, which being not only new, but contrary to received opinions, require some demonstration.—Though I might, indeed, have delivered them, without any physiological or medicinal discussion of their proof, as simple propositions; yet they would then have had no support, but a mere single *ipse dixit*, against the authority of a number of other writers. To give them due weight, it was necessary to prove them by arguments: and those arguments could be founded only on scientific reasonings, and principles,

ples. — The readers, who are less judges of this demonstrative part, may, nevertheless, yet comprehend well the matters proved, and they should consider the means of proof, as an appeal to others versed in the relative sciences, which establish a just ground for their own confidence, or assent. — To offer new opinions, in matters of great consequence, against confirmed notions, without assigning any reasons for them, would be as unsuccessful in the effect, as arrogant in the appearance. — The manner, in which I have treated the subject, being, therefore, necessary on this score, I hope the abstrusity, and prolixity, which to some, may seem to arise from it, will be candidly dispensed with: since nothing, should be omitted on such an occasion, that tends to promote a matter of so great concern to the national welfare, as the endeavouring to avert, or, if it should come on, alleviate one of the greatest calamities, that can possibly befall any country: the danger of which is at this time most evidently impending over us.

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MEMOIRS

M E M O I R S
OF
AGRICULTURE.

AND OTHER

OECONOMICAL ARTS.

ARTICLE I.

*Account of an improved Method of cultivating
Lucern, communicated by CHRISTOPHER
BALDWIN, Esq. to the Society for the En-
couragement of Arts, Manufactures, and
Commerce; and inserted here at their Re-
quest.*

To Robert Dossie, Esq.

SIR,

THE Society for the Encouragement
of Arts, Manufactures, and Com-
merce, have directed me to deliver to
you Mr. Baldwin's letter, in order to it's being
published in the Memoirs of Agriculture, if
you think proper.

By Order,

PETER TEMPLEMAN.

VOL. II.

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SIR,

SIR,

AS I am always desirous of employing my leisure hours to some valuable purpose, so I am tempted to lay before you an account of my experiments and observations in the culture of lucern, that you may judge, if my time is spent with any advantage to my country, as I anxiously wish it may, and with a view to promote the great end of your most useful Society.

The excellence of lucern as a food for cattle of every kind, either in its succulent state, or as hay, is so well known, that I shall say nothing as to its merit in those respects, but take it for granted it is generally allowed by every gentleman and farmer, who is acquainted with it: the great object I have in view, is to point out the method of cultivating it at the least expence, and to shew the public its advantages over every other grass; and that upon lands which cannot be made to carry grass with advantage, for any number of years, but must be kept in tillage, and only come into grass in rotation with other crops.

The present known methods of cultivating this grass, are by drilling the seed, or transplanting at certain distances, and by broad cast; some recommend one method, some another, each with a preference to their favourite scheme; however, it is certain that lucern may be cultivated with great advantage in either method: when it is cultivated

In regard to the distance of the rows, Mr. Tull, Monsr. Lullin, Duhamell, all the French and many English writers, lay it down as a determined point, that lucern should be cultivated at three feet four inches distant from row to row; but for my part, I must beg leave to differ in opinion with these gentlemen; and as I speak from experience, as you will see by the following experiments, I hope it will not be thought presumption: for though I am far from pronouncing positively, yet I am a little inclined to think these gentlemen say, the intermediate space *must* be three feet four inches, because they were at a loss for instruments that would effectually clean it, if the space was less.

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prised

prised to find it weigh seventy-two pounds. I own I had no idea of its yielding any thing like this; nor did I think of trying, till one day recollecting the Irish rod was twenty-one feet square, I reduced Mr. Baker's produce to our measure of sixteen feet and half, and found it to be, as before-mentioned, seventy-two pounds.

Mr. Baker has laid before the Dublin Society an excellent series of experiments, tending to point out the most advantageous method of cultivating this valuable grass. He says, that from a rod of lucern

In 3 feet drills, he mowed green	lb.
2 feet	27
1 foot	26
broad cast	37

It is proper to observe here, that this is according to English measure, and that it was from his first year's growth. In this gentleman's last year's account of the next crop, he says he cut on

	In 3 feet drills.	2 feet drills.	1 foot drills.	broad cast.	transplanted.
	h. q. lb.	h. q. lb.	l. q. lb.	l. q. lb.	l. q. lb.
4th June	0 1 20	0 1 23	0 2 12	0 3 14	0 2 3
27th Aug.	0 1 3	0 1 7	0 0 24	0 0 18	0 1 15
10th Oct.	0 1 17	0 1 19	0 1 4	0 0 0	0 1 19
	1 0 12	1 0 21	1 0 12	1 0 4	1 1 9

I have laid before you these very accurate experiments, that you may be able to judge with the greater precision of the merit of the method I have pursued; and from the success which

which has attended it, I beg leave to recommend to others, not doubting but they will be pleased with their success.

The field of lucern, in which I made my experiments, contains about four acres. In September, 1764, I transplanted two acres, and in May, 1765, I drilled another acre; both are at twenty inches apart in the rows: this is just half the so much recommended distance, viz. three feet four inches. As I could not conceive that a tap-rooted plant, like lucern, could require such a space of surface, I determined upon taking only half the quantity; fully convinced, that if I found the plant required more room, I could then take up every other row, and leave the remainder at three feet four inches; but my success has been such that I have no longer any thoughts of altering my plan; on the contrary, I have brought the remaining acre into drilled lucern, as it lay parallel to the other drilled acre. This was done last spring, after it had been well ploughed, by sowing first in broadcast, two bushels of barley on the 30th of March, and from the 8th to the 11th of April it was drilled by hand with lucern, in rows parallel to the others; and the expence I found to be about ten shillings per acre.

I shall now lay before you an account of my crops for last year, being the third year of its growth. I began cutting on the 11th of May; and on the 30th of that month I cut a rod

square of drilled, and found the weight three quarters eleven pounds, i. e. ninety-five pounds. On the 19th of June a rod of transplanted, then in full-bloom, weighed one hundred weight and eight pounds, i. e. one hundred and twenty pounds. On the 16th of July, I found the second crop weighed on an average two quarters of a hundred six pounds, i. e. sixty-two pounds. On the 27th of August, I found the average-weight of the third crop to be one quarter twelve pounds, i. e. forty pounds; and about one half the field was cut the latter end of September the fourth time, when a rod weighed one quarter two pounds, i. e. thirty pounds. Now if you take the medium weight of

	h.	q.	lb.
the first crop, which is	0	3	24
the second ditto,	0	2	6
the third ditto,	0	1	12
only half the fourth,	0	0	15
	2	0	1

you will find that a rod square yielded me two hundred and one pound; and I think will convince you, that my method is superior to the other: indeed, as I have before hinted, it is difficult to conceive of what advantage three feet four inches of the surface can be to a tap-rooted plant. If the advocates for a larger space, say it is absolutely necessary to destroy the weeds and keep the surface loose, this I can do with my instruments, as effectually as they can; but still the quantity produced,

produced, must determine the merit as to the mode of culture : and I have no doubt, but it will determine it in the breast of every impartial husbandman ; though I mean only to make you acquainted with the advantages arising from my method of cultivating this grass ; anxiously hoping, that a better method may yet be discovered by others.

I must not omit telling you, that on the 16th of July last, I cut from a broad-cast field of lucern, in full bloom, a rod square, and found the weight to be one hundred and twenty-six pounds, that is, one hundred and thirty-eight pounds. I am sorry to say, I neglected weighing any more in this field ; but can with great pleasure inform you, that it was cut three times, and that the three stacks are computed to contain eighteen loads. The field is four acres and a half, and the lucern seven years old ; nor is this an uncommon produce from broad-cast lucern : a very valuable member of your society made forty-eight loads of hay from about eleven acres in the parish of Mitcham, two years ago ; but the land, though very fine, yet being wet, it went off, and ever will do so upon wet land. I have seen prodigious crops on such lands for two or three years, but it always goes off about that age : dry light land, in tolerable condition, with a deep staple, appears to be the best adapted to the culture of lucern : mine is light, but very stony for about eight

or ten inches ; under that, a rock of gravel : and surely it must be deemed a great happiness to this country, that at a time when we so much abound in horses, a grass is found to thrive best upon lands but indifferently adapted to the growth of natural grass.

I had an opportunity last summer of making some observations, which I think worthy of being laid before you : With part of the first crop I fed my own horses and cows, the remainder I made into hay ; and it is hardly necessary to say, no hay is superior ; indeed I believe none equal to it for sweetness and nutritive quality. The second crop I sold in my neighbourhood, to foil horses, when I had the pleasure to find every one much pleased with its excellence as a green food ; and as it was all weighed out to each person, I had an opportunity of discovering that a coach-horse would eat in the twenty-four hours ninety pounds. Mr. Baker has calculated upon forty-nine pounds ; but I have no doubt but a gentleman of his great accuracy has since discovered, that a large-sized horse will actually eat full ninety pounds in twenty-four hours. I was also from hence led to observe, that an acre would feed at this rate five horses for twenty-one days. Observations of this sort have their advantage, as by this means gentlemen and farmers are enabled to determine what quantity of ground it is necessary for them to lay down for their respective number of horses ;

horses ; though prudence will dictate to them to allow rather too much than too little.

In the course of my experiments I have observed that lucern is not only excellent as a food for horses, but also as a physic : its effects are not only like those of green tares or clover, for it does not make horses foggy in their work as they do, neither does it operate much as a purgative, but surprisingly as a diuretic, inso-much that if care is not taken, in a stable with five or six horses, it will be in a manner flooded ; and though I have attended to it very carefully, I have not been able to discover any great advantage from giving them corn when they are fed upon green lucern ; however one quartern is fully sufficient for a saddle or coach-horse ; and I have seen among the horses I soiled this summer, some which were in the lowest state as to flesh, surprisingly recovered in the course of a month ; and one in particular, reduced very low by a violent purging of long standing, to which the greatest astringents could give no relief, was in three days time perfectly restored to proper habit of body in that respect : it acted as an alterative, bringing on a great discharge of urine, and in five weeks time the horse was again in full flesh. Last year, and this, I fattened small Welch wethers on lucern, and they all yielded from eleven and half to twelve and half pounds of fat : and though I had great difficulty in keeping them at first in my
other

other fields, yet I never found that they attempted to go out of the lucern, though there are several gaps in that field.

It remains now that I inform you of the instruments which I have invented for clearing lucern in rows, either drilled or transplanted; not that the use of these instruments, one of which is a horse-hoe, the other a hoe-plough, are by any means confined to the culture of lucern only; on the contrary, they may likewise be very advantageously used in the cultivation of any other plant in equi-distant rows.

The foreign horse-hoes, and also those which I have seen in the Society's possession, which in general are constructed upon the principle of one broad share, or hoe, I venture to pronounce inadequate to, and improper for the purpose; for if the land is stony, the share is thrown out of its bias, and the plants are cut up, sometimes on one side, sometimes on the other; nor can the skill of the most able ploughman prevent it: of this kind is the famous Mons. Lullin de Chateauvieux's Single Cultivator, one of which I had made from a drawing in Mr. Mills's excellent System of Husbandry. I was pleased with its appearance in the plate; but from experience, I found the bad consequence before-mentioned attending it, and was therefore forced to give up the use of it.

Clearing lucern in rows, by over-hand or
Dutch

Dutch hoes, I found so very expensive, that no farmer can support it, and I pay little regard to what may be done by the mere dint of money; it is the ballance of the account, in a national light alone, that can engage my attention.

In the autumn 1766, finding my drilled and transplanted lucern was got very foul again, and knowing the expence of hand-hoeing was very great, I knew not well what steps to take; however, I got a worthy member of your Society to shew me the instruments which had been laid before them, for clearing lucern in rows: these I found as before-mentioned, all go on the principle of one broad share, which I knew from experience would not answer in *stony ground*.

Necessity is truly said to be the mother of invention; for, in my distress, I was drove to try my own little mechanical abilities; and having seen the errors of others, I endeavoured to avoid them: therefore, instead of one broad share, I have several harrow-tines and small hoes, so disposed, that though some may strike against a stone, yet from the smallness of the size, the shock is lessened; they are less liable to be interrupted, and the others serve to give steadiness, by which means this horse-hoe is always kept properly at work; and many gentlemen who have seen it work, have all declared themselves perfectly well satisfied with its performance.

As

As my field was over-run with grafs, and full of weeds, when I first made use of my horse-hoe, so it brought up such quantities, that I carted off six loads from three acres : but notwithstanding the great advantage of this instrument in cleaning lucern from weeds, yet it operates only on the surface like other hoes, that is, about an inch deep ; however, grafs and weeds will return ; and I was well convinced, that if an instrument could be contrived, that would give a deep ploughing between the rows which were only twenty inches apart, it would contribute yet more to destroy the weeds, and be of great service to the plants themselves. Upon this I tried a small plough which I commonly use ; but I soon found it would not answer, as it threw up so large a quantity of mould, that the plants were quite buried : this difficulty, after considering some time on the sort of instrument necessary for obtaining the end I proposed, led me to invent my *hoe-plough*, which did its business in the completest manner I could wish. It was worked up and down each row, and brought up great quantities of couch and tap-rooted weeds, which the horse-hoe could not reach. After the field was hoe-ploughed in this manner, which was in November 1766, it was laid smooth again with a pair of common harrows worked across the rows, and near two loads more of weeds and trumpery carted off.

Both

Both these instruments are easily worked with one horse; and I flatter myself, they will be found to have the principal requisites in instruments of this kind, that is strength, and simplicity of construction. Complicated implements of husbandry, frighten the farmer and his ploughman; these, the most ignorant may use with facility: indeed, if I may be allowed to say it, they of themselves plainly point out the uses to which they are adapted and intended. I will only add one more advantage that attends them, which is cheapness, viz. about thirty shillings each; and I should be glad to recommend to the Society, the person who makes them, (under my direction) as a person worthy of notice on many accounts. His direction is, "K. Edwards, wheel-wright, near the Plough, Clapham."

Since my first inventing these instruments, I have never used any hand-hoeing; my method is to pass the horse-hoe through the rows after each mowing. In the winter, I give the field a good ploughing with the hoe-plough; and in the spring lay it smooth with the horse-hoe: two acres may be done in a day; so that the expence of cleaning lucern, is by these instruments reduced to a mere trifle.

When a field of lucern in rows, is so extremely foul, that it is thought hardly possible to recover it, I would have the hoes under the
handles

handles taken out, and the three large tines put in their place; then pass it once over, lifting it up behind every now and then as it goes on, to drop the great quantity of weeds which it collects; after which, cart off these weeds, then replace the hoes, and go over the field again, when I have no doubt but every gentleman will be surprised at its effect.

I hope I may now flatter myself with having pointed out a method of cultivating this valuable grass, at the least expence, and shown its advantage over every other grass, by showing a mode of culture superior to that which has been so much recommended; I shall therefore close the subject, by pointing out the proper times for cleaning broad-cast lucern by harrows, which, from experience, I see answer the purpose perfectly well; therefore let the first crop, when intended for hay, be carted as it is cut, to another field, and the harrow set to work immediately; for at this time, the ground is in a loose state, the weeds weak, and many of them very shallow rooted; so that one tine is of more service than three, when the ground is become settled and hard. — Another critical season for harrowing lucern, is, in the winter upon the breaking up of a frost, when the ground is in a loose perforated condition; owing to the fermentation occasioned by the nitrous salts then soaking into the earth, so that the grass and weeds are in a manner lifted up and exposed
to

to the tines of the harrows; whereas the lucern, from its deep tap-root, is kept firm, and out of reach from the harrows.

I shall now beg leave to conclude this long account, which, I hope, will prove fully satisfactory to the Society, with just adding, that if any gentleman who has purchased these instruments, find the least difficulty in working them, I shall have great pleasure in removing those difficulties, if they will do me the honour to call at my house.

I am Sir,

Your most obedient servant,

Clapham-Common,
Novemb. 1767.

CHRISTOPHER BALDWIN.

ARTICLE

ARTICLE II.

Directions for making a cheap, strong, durable, and handsome Coping for Walls, communicated by the late PETER WYCH, Esq. to the Society for the Encouragement of Arts, Manufactures, and Commerce, and inserted here at their Request.

To Robert Dossie, Esq.

S I R,

THE Society for the Encouragement of Arts, Manufactures, and Commerce, have directed me to deliver to you Mr. WYCH's letter on Coping, in order to its being published in the Memoirs of Agriculture, if you think proper.

By Order,

PETER TEMPLEMAN.

TO make a coping of plaster for all exterior walls, such as garden-walls, pond-heads, park-walls, &c. take a quantity of such plaster * as is commonly used for floors,

* Any tarras, plaster, or calcined gypsum, may be applied to this purpose as well as that here mentioned to be obtained in Nottinghamshire. The fresh, which has been only once calcined, will be the best. For though Mr. Wych below mentions such as has been before employed and several times burnt, yet it is well known, that plaster loses much of its binding or cohesive quality every time it is calcined after the first.

in

in and about the county of Nottingham, burnt in the manner there practised. Then beat it, and sift it, till it be rendered quite a fine powder. This done, to every eight bushels of the powder, add one bushel of well-calcined ashes of Nottingham-coal, that are perfectly clear of sand or kitchen-dust: the best ashes for this purpose are those of brew-houses, or glass-houses, if they can be conveniently procured. When this mixture is made, put it into a trough; and pour water thereon till you make a paste of it, like good mortar. Then cast it in frames on your wall to the thickness of two inches on at each side; and to rise to three inches in the center: after which trowel it. The four sides of the frames are to be made of wood, twelve feet in length, two inches high, and the breadth the thickness of the wall.—When you remove your frame in order to lay another length of coping, you are to leave an interval of two inches between the last and next succeeding length: because plaster has the property of extending itself; and that always in a straight line. Therefore, in a few years, those intervals will be filled up. If you find that the intervals fill up too soon, you are then to saw off a part of it, to give it room to extend: otherwise, it will rise in the middle; and a hollow will be left between the wall and coping. The appearance of this coping at first is in colour like lead, beautiful to look at: and the coping itself

is as durable as free-stone. In Nottinghamshire, free-stone work, thus laid, is computed at two shillings the square-foot: whereas this plaster-coping will not stand you in more than three-halfpence; and answer all the purposes as well. At Godeby, in the county of Leicesters, Mr. Wyche has used this kind of coping prepared exactly as above-mentioned: and the work has stood perfectly sound for upwards of twenty years: and now gathers moss, which is a sure sign of durability.—The utility of this coping is much to be esteemed: as, in a little time, a great quantity of work may be done. For what in stone-coping will take up six months, with the like number of hands, will be performed in plaster-coping in one month.

N. B. In the above account, it must be observed, that the proportion of eight bushels of plaster-powder, to one bushel of calcined ashes, is proper, when you use old plaster, that has served for several uses before, and has been often burnt. — But if you use new plaster dug out of the pit for the purpose of coping, you are then, to every four or five bushels of powder, to add one bushel of ashes.

P. S. When you build your walls for this kind of coping, remember to lay your last course of bricks, so as to project one inch from

from the wall. This done, take care to level the top of the wall, with a thin coat of mortar, that the surface of the wall may be perfectly smooth, from one end to the other. When the mortar is quite dry, lay your coping on it, that by having a level foundation, it may extend itself freely. But, if by any hole's being left in the work, the extension be retarded, its force will greatly damage the wall.

December 22d, 1760.

After some years, when the work appears rough, you may spread over it a thin coat of plaster, mixed as above directed; and the whole will appear as new-laid, just as a cieling appears fresh after white-washing.

ARTICLE III.

Account of a Method of making Mortar, which will be impenetrable to Moisture, acquire great Hardness, and be exceedingly durable, presumed to be that used by the Antients.

THE following method of preparing mortar was communicated, by me, to the Society for the Encouragement of Arts, Manufactures, and Commerce, in the year 1760. The advantages of this method were discovered, after trial of many others, by a gentleman, at Neufchatel, in consequence of the following circumstances. He had a house, the back-part of which being cut out of a rocky hill, the springs of water forced their way through the walls, wainscot, plaster, or whatever he used as a facing to the rock; and rendered the rooms very detrimentally wet. He was necessarily led to endeavour, by the use of all the common compositions, to exclude the moisture: but every thing failed to effect this purpose, till he tried the mortar below described. This he found perfectly answered his end of preventing any transudation of the water: and it grew so tenacious and firm, by time, that he was induced to believe the method of composition was the same with that pursued by the antients in

in preparing their mortar. In this light, as a discovery of the mortar of the antients, he communicated it to Lord M——, at that time residing at Neufchatel, to whom he shewed the rooms he had rendered dry by means of it; and which had then been plastered with it about eleven years. The plaster appeared as white as marble; and nearly as hard: nor was there the least sign of any moisture's pervading it in the places where, before it was applied, the water from the rock had continually forced its way, in spite of the various other means that had been employed to exclude it. Lord M—— believing this discovery to be a matter of utility, gave the recipe, and the particulars of the account, to me, as he had them in writing from this gentleman; in order that I might impart them to the public, in what manner I should think proper, if there were any prospect of their being of advantage. I accordingly delivered a memoir, containing a translation of them, with some additional remarks, to the Society for the Encouragement of Arts, &c. with the view of having them inserted in the Historical Register, which was then proposed to be published annually by them. But the design of publishing such a Register not taking place, and the memoir having been lost out of the Society's Gard-book, I thought it expedient to make a fresh communication of it in this place: as it may very properly fol-

low the foregoing valuable article of a method for making coping for walls. — The manner of preparing this mortar is as follows :

“ Take of unslacked lime, and of fine
“ sand, in the proportion of one part of the
“ lime to three parts of the sand, as much as
“ a labourer can well manage at once : and
“ then, adding water gradually, mix the
“ whole well together by means of a trowel,
“ till it be reduced to the consistence of mortar.
“ Apply it immediately, while it is
“ yet hot, to the purpose, either of mortar,
“ as a cement to brick or stone ; or of plaster
“ for the surface of any building. It
“ will then ferment for some days, in drier
“ places ; and afterwards gradually concrete
“ or set ; and become hard. But in a moist
“ place it will continue soft for three weeks
“ or more ; though it will, at length, attain a
“ firm consistence, even if water have such access
“ to it so as to keep the surface wet the
“ whole time. After this, it will acquire a
“ stone-like hardness ; and resist all moisture.
“ The perfection of this mortar depends
“ on the ingredients being thoroughly blended
“ together ; and the mixture’s being applied
“ immediately after to the place where it is
“ wanted. In order to this, about five labourers
“ should be employed for mixing the
“ mortar, to attend one person, who applies
“ it.”

Chalk-

Chalk-lime, which is the kind most commonly used in London, is not fit for this purpose, on account of its containing flints; which makes it require to be skreened before it can be tempered with the water and sand. This skreening renders the slacking the lime previously necessary: and the slacking it before it be mixt with the sand prevents its acting on the sand, so as to produce their incorporation; which power it loses, in a great degree, after its combination with the quantity of water that saturates it. Lime made of lime-stone, shells, or marble, must be therefore had for this purpose: and the stronger it is, the better the mortar will be. If such lime be wanted for this end in London, though it is not commonly used there, it may be obtained at some of the wharfs; or at a work, carrying on for making stone-lime, on the banks of the river Thames, above Vaux-hall.

Besides this regard to the kind of the lime designed to be employed in making the above-mentioned mortar, that which is intended for it should be carefully kept from the access of air or any wet: otherwise it will attract moisture; and lose proportionably that power of acting on the sand, by which their incorporation is produced. It is proper, also, to exclude the sun and wind from the mortar itself for some days after it is applied: that the drying too fast may not prevent the due

continuance of the fermentation, which is necessary for the action of the lime on the sand.

Over and above the value of a very hard and durable mortar, for general purposes, the property which this kind has in resisting and excluding all moisture, gives it very peculiar advantages in particular cases. For, as it may be used, and will grow perfectly hard, even though moisture have access to it when laid on, and while it is fermenting and setting, it is of very high utility for preventing the ousting of water through the floors or sides of many edifices; as well vaults as others, where mortar prepared in the common method would fail of that effect; and continue wet for any length of time. It is, likewise, of great consequence in the erecting bridges, or in making the foundations, or other parts of buildings raised in water, or situated in very damp places; or for pointing, or plastering conduits, or reservoirs of water: for which last purpose, it appears to answer the end of tarras, or the gypseous plaster; and may save the expence of those materials; which are generally much dearer than lime. The superiority of this to the common mortar is owing to the intimate commixture of the lime with the sand, at the same time it is combined with the water, before its attractive power be diminished by its combination with water: and this shews the defect in the common method of making mortar: where the lime is slacked before it is
4 commixed

commixed with the sand; and where, in part, old mortar, common earth, or other substances, with which lime has no peculiar specific attraction, are generally added, or used wholly in the place of sand. Such mortar is frequently found, instead of growing harder with time, to appear, as it were, calcined in some years; and to moulder into dust: especially where the air has access. The slackening the lime before its mixture with the sand is, in a great measure, unavoidable in the case of such as is made of chalk, for the reason above assigned: and other lime bears a higher price in London. The expence of labour, also, in mixing the lime and sand with a trowel, as directed in the recipe, instead of beating them together in the common way, is, perhaps, too great every-where for preparing mortar for general purposes. But in the extraordinary cases, above enumerated, it will be found to answer: and in all cases it is proper to have regard to the principles, on which the goodness of mortar so prepared depends; and to come as near this method as circumstances will admit.

When a very great hardness and firmness are required in this mortar, as in several cases where strong cement is wanted for stones; or for projecting parts of buildings, or other purposes; the using of skimmed milk instead of water, either wholly or in part, will produce the desired effect; and render the mortar extremely tenacious and durable. It

It is confirmed, by the accounts, we have in Pliny, Vitruvius, &c. of the Roman mortar, that the gentleman, who concluded, from his observations of the similitude of the consistence of the mortar he thus prepared, with what is found in the antient buildings, the manner of preparing them was the same, was not mistaken in his conjecture. For it appears, the same method of preparation was followed then in the mortar made in great quantities for common purposes : only there is reason to believe, that milk, also, was used in some particular cases, either wholly or in part, instead of water. The appearance of perpetual durability, and the exceeding great hardness of the mortar now found in the remains of the antient buildings, are proofs of the excellence of this method ; and shew, that it ought to be attended to in all instances, where long duration is of moment. The total deviation from it in the preparation of the mortar for many of our buildings, particularly in London, is the occasion of the quick decay of them ; or frequently of the immediate fall of houses or parts of houses, even before they are finished ; and the means also, of great fraud on the purchasing proprietors of such houses ; as well as danger to the tenants, and even passengers. Whence, it calls loudly for the control of the legislature, to punish such as do not use fit materials in the composition of mortar.

ROBERT DOSSIE.

ARTICLE IV.

Observations on the comparative Utility of the Drill and Broad-cast Methods of Husbandry; and on the Turnep-cabbage; communicated in a Letter from the Rev. Mr. EDWARD HOWMAN, of Giffing, in Norfolk.

To Robert Dossie, Esq.

SIR,

I Have just had the pleasure of perusing the first volume of the Memoirs of Agriculture, &c. a work which I esteem a very valuable acquisition to the public.

As a lover of husbandry, I was particularly pleased with Sir Digby Legard's course of experiments, relative to the comparative profits of the old and new husbandry: which I look upon to be the best conducted, in order to shew the respective merits of the two modes, in a comparative point of view, of any in our own country, that have come to my knowledge.

These experiments have caused some reflections to occur to me relative to the absolute merits of the old and new husbandry, with respect to the public; which I shall take the liberty of communicating to you. I ought, perhaps, to apologize for so doing: as I have at present very little experimental matter to communicate; (nothing, indeed, relating to the new husbandry).

But

But I cannot help thinking, that reasoning upon the experiments of others may, sometimes be as profitable, as the making experiments one's self. Whether what I have to offer be of this sort, I will not pretend to determine. You are at liberty to make what use of it you judge proper : either to insert it in the Memoirs ; or to destroy it. It is a particular satisfaction to me, that, in the Memoirs, no one will be in danger of being treated in that illiberal manner, for a difference of opinion, which many were in the Museum, Rusticum ; much to the discredit, if not the entire destruction * of that otherwise valuable publication.

The principles of the new husbandry certainly are not to be controverted : and we are under the greatest obligations to our countryman Mr. Tull, as his principles are very advantageously applicable to husbandry in general.

* This complaint of the conduct of the Museum Rusticum had too much foundation before the last eight months of its duration : but the direction of it then fell into my hands : and every thing which could reasonably be deemed exceptionable, was during that time rejected. Though the former indiscreet management, in this point, might justly give reason for such a notion, yet the discontinuance of that work was not owing to a decline of the public favour ; but merely to some circumstances in the œconomical concerns, which determined the proprietors to cease the publication. The strictest care will be taken to merit the compliment Mr. Howman has made to the Memoirs of Agriculture on this account. R. D.

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The drill-method must certainly at present be very profitable in some particulars; but yet I must confess, that I have many doubts, whether the public would receive any advantage from the *universal* * prevalence of it. Sir Digby Legard very justly observes, that the comparison is not to be made between the old and new husbandry, but between the use of the drill and the broad-cast husbandry, according to the mo-

* The warmest of the rational advocates for the drill-husbandry have never pretended that the *universal* practice of it in the culture of wheat would afford either public or private benefit. The Society had in view, in their premiums for the comparison of this method with the broad-cast, to procure such experiments of its application to the culture of all the kinds of plants where there was the least probability of its being advantageous, as might determine in what instances, and with what limitations, it might be substituted for the broad-cast method.—Wheat being the most important of all grain, the attention of the improvers of husbandry has been mostly turned to the trials of this method on that subject: and the accounts already laid before the public, provide some foundation towards deciding, that there are particular cases where it may be profitable both to the farmer and the public; but various others where it cannot be beneficial to either.—In the culture of beans and lucern, there seems already very good grounds for determining that the drill-culture is superior to the broad-cast; though the Society have, this year, continued their premiums respecting those subjects.—As to turneps, there is hitherto such a division of opinion supported by such a difference in the events of trials, that it requires a further extension of observations to conclude demonstratively, whether in general, or under what particular circumstances, the one ought to have the preference to the other, R. D.

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dern improvements adopted by the common farmer, of introducing clover, and turneps, instead of fallows. Therefore, though it is proved, that the drill-husbandry exceeds any of the fallow courses; yet it proves nothing relative to the question in hand : as appears to be the case of the experiments of the rev. Mr. Lowther; in which, the drill method was tried against the common course of husbandry pursued in his neighbourhood, in Cumberland: and which, surely, is one of the most wretched courses, that ever were practised. Sir D. Legard, moreover, observes, that “ the superiority of one method over another is not to be determined by its advantage in a particular crop; but by many successive ones.” That is, though an acre of broad-cast, has always, in his experiments, produced more wheat, or barley, than an acre of drilled; yet, in the full course of clover, wheat, turneps, and barley, (which certainly is the most approved course, and with which he judiciously made the comparison), the drill is most advantageous. That it was most *profitable*, in Sir D. Legard’s experiments, I readily acknowledge. But I am confident, from that gentleman’s great candour in his relation, that he will not take it amiss, if I declare my dissent from it, as a general proposition, that, therefore, the drill is the superior *

* The word *superior*, when applied to the drill-husbandry, in the culture of wheat, compared with the broad-cast,

method. For the public it certainly cannot be most profitable; whilst it produces a less quantity of grain upon a given quantity of land. For then, in order to raise the same quantity of grain, [we must take more land: and, if so, what becomes of our clover and turneps, the necessary provision for our live stock? If, on the contrary, we should in the drill-way cultivate the same quantity of land for each respective crop, as we do now, then there would be a deficiency in every crop. I think, therefore, that the drill never can be pronounced to be the superior method, till it can be *demonstrated*, that it produces an equal quantity of grain, acre for acre. Then, indeed, I will acknowledge it to be vastly superior; as there will be a saving of seed, (a great national consideration): and a great quantity of manure may be applied to pasture-land with much profit. I do sincerely hope, that Sir Digby Legard, who appears so remarkably well qualified, will persevere in his experiments till he has clearly demonstrated, whether the drill-husbandry will, or will not

cast, must be taken in a limited, and not an absolute sense. As far as any improvements in the drill-culture have been hitherto laid open to the world, there are more cases where the broad-cast would be advantageous than the drill, both to the farmer and the public: though the introduction of it in others appears to be attended with benefit to both.— So that it must be only understood to be *superior*, in particular situations and circumstances. R. D.

produce

produce an equal * quantity of grain upon a given quantity of land. I know he will try it against the best broad-cast husbandry: but I must take the liberty of adding, that it will not be an equal trial, unless the course of broad-cast be cultivated by himself; and, in as masterly a manner as the others, with the addition of as much of the principles of the new husbandry, as the broad-cast is capable of in practice †.

* According to the present common methods of drilling, it is evident, that the crops of wheat obtained for a number of years successively, are by no means equal to those which may be had from broad-cast in single years, with the intervention of lea, or turnep-fallows, and other favourable crops. Sir Digby Legard has given into the Society an account of further experiments, which are below inserted; and confirm in general, the conclusions afforded by his former accounts. It does not seem very probable that when much less than half the real quantity of ground is sown, it should be made by art to afford crops as great as where the whole real quantity is sown in the common way; except in the case of plants, which, requiring air to the bottom of the stalk, in order to their bearing well, demand intervals for their producing full crops.

But this, though true of beans and pulse, does not hold good, in such a proportion, of corn: which bears its seed at the top of the stalk; and does not require an equal exposure to the air downwards. It is, however, said, on some foundation of experiments, that, by lessening the intervals in the drilling, much more than has been hitherto done, the crops may be made equal to the broad-cast. But neither the instruments for this performance, nor their manner of use, have been made known to the public. R. D.

† There seems no reason to expect, from the nature of the subject, that, the greatest improvement of broad-cast, in the culture of wheat, on the principles, which make

I am emboldened to add this, from a remarkable instance, which I experienced the last year, of what the principles of pulverization *alone* will perform in the broad-cast.

In the beginning of April, 1768, I sowed three acres, part of a piece of my glebe, with white oats. It was a tolerable mixed soil; neither very strong, nor very light; but rather strong. The whole was oats, the year before: and, in order to put it in course with some other land, it was all intended for turneps. But, as I happened not to have occasion for so many, I thought I might steal a crop of oats from the lower half:

make the drill-method beneficial, can ever render it equal for the same purposes. The end of drilling is to maintain a partial fallow continually in alternate parts of the ground, (the intervals being in the state of fallow under the highest tillage) which may answer the end, and save in part the loss or expence of lea fallows and manure, and become profitable on the whole, in consequence of the continual crops obtained from the part that is sown: which crops, though not so great as in the broad-cast method, where the whole is sown, may be yet advantageous; because they are constant. This is, nevertheless, applicable with profit only in particular cases: but, unless some improvement of broad-cast should make it admit of constant successive crops of wheat, it could not answer the purposes of drilling wheat in such cases. What these particular cases are where the drill-method may be advantageous; as deduced from facts established by experiments, according to the present method of practising it; and from what principles the reason of such advantage arises in those cases, will be specified and explained in the observations on this subject in a subsequent article. R. D.

which seemed to be in rather the best heart. Accordingly it was well ploughed three times. It was also twice rolled, and three times harrowed; and was thereby reduced as fine as a well-cultivated garden. The quantity of seed sown was one comb per acre: or, (as I believe, that may be a provincial expression) four bushels. As this was a pretty full quantity of seed, I was surprised to observe, that it came up very thin: and I began to be of opinion, that I had done a silly thing, in sowing oats after oats upon that land. For it is to be observed, that I had then occupied it six years; during which, I had not laid any *manure* whatsoever upon it: and I dare say, it had not had much to boast of for many years before; being at a considerable distance from the parsonage. The oats, however, gained ground amazingly; and soon shewed, by their colour, and their branching, that they would be a remarkable large crop: and a remarkable crop they were, indeed! For they yielded no less than seventeen comb, or eight quarters and a half per acre, of fine oats. I shall lay no stress upon this in point of argument; as it is a single instance. But I must think, it is a strong presumption, that the principles of the new husbandry may be applied to the practice of the old, with astonishing advantage.

I have given my reasons, why I doubted, whether the public would receive advantage

from the universal practice of the drill-husbandry. I must now beg leave to mention, that I have some doubts, likewise, relative to the farmers profit. That the drill had a clear, and considerable advantage, in Sir Digby Legard's experiments, is certain; and probably, as things stand at present, would in any *particular* case. But the fallacy seems to be this: the profit, in a great measure, arises from cultivating the sum total of the land with grain in the drill-instance: whereas, the broad-cast must be divided into four equal parts, so that the value of the grain produced by the drill, exceeds the value of the grain, turneps, and clover, produced by the broad-cast. But this would be an impossibility in universal practice; some part of the land must be appropriated to clover and turneps: which circumstance, perhaps, would considerably deduct from the difference of profit. But, besides, if the farmer in general, deluded by present appearance, should, by the drill, encrease his quantity of grain *only*, by the exclusion of clover and turneps, the value of the former would fall; and the value of the other must rise in a reciprocal proportion: so that the ballance would be preserved: and it does not appear, that any advantage would be gained that way.

Before I quit this subject I must just observe, that though I have not the least objection to Sir Digby Legard's calculation; as it

appears to be made with as much candour and exactness as a calculation of that kind can be ; yet I have one great objection to such sort of calculations in general. It is this : the sum total of profit or loss, in each particular case, must come out extremely different, in different counties in England, according to the different prices of labour, and to the variations in the value of the respective crops ; and, likewise, of manure of different sorts. For instance ; the county of Norfolk is, in general, extraordinarily well cultivated. There are numerous droves of beasts brought up from Scotland, and the North of England ; and fattened here, upon turneps, for the London-market, in the spring. . So that this is equally a grazing and a corn-country. The city of Norwich, and other large towns in the county, take off great quantities of clover. For these reasons, turneps, and clover, are so much more valuable here, than they appear to be in Sir Digby Legard's calculation, that they would bring out the net profit much more favourable to the broad-cast husbandry, according to Sir Digby's own experiment. Manure, likewise, does not appear to be so dear here, as it is rated in his experiment : in some measure, arising, perhaps, from the quantities of cattle grazed here. If I were to add to this, that the quantity of grain, produced by the broad-cast experiment, seems to fall short of what is usually produced by
such

such sort of land here, I might possibly make the sum-total of profit come out to the advantage of the broad-cast. For the above-mentioned reasons, I should think it better, in such experiments, not to calculate the profits in money, as it may mislead; but only to relate the labour bestowed, the manure expended, and the quantity of grain, &c. produced in each method: leaving to others to make out the loss, or gain, according to the respective value of each article in their different situations *.

* It seems very necessary, for the ease and satisfaction of the reader, to specify the actual expence occurring in the culture described in experiments of this kind, by giving the rate or charge of each article; and stating the ballance of the disbursement and return. The greatest explicitness in this point is, likewise, necessary, in order to lay those conclusions demonstratively before the public, for which the experiments are intended to furnish the *data*, with respect to the comparative profit or loss of the two methods in question. These conclusions depending, however, on rates, which vary much in different places, can only avail locally where a similarity of circumstances subsist. But whoever would know, how far they do hold good, or fail in any particular place, may as easily change the rates in the original account, and adapt them to the circumstances of such place, as if blanks had been left for them in each article.—The universality of the preference of the drill-culture to the broad cast, being given up, the more particular the accounts of the profit or loss of it in particular places, or cases, are; and the more lights the public will be furnished with, for determining, where it may be tried with a prospect of advantage; or where it appears impracticable. This both tends to the more general introduction of this culture where it may be beneficial; and to the avoiding those attempts of it, where it would be fruitless and injurious. R. D.

I have lately had two instances of what Sir Digby Legard mentions, relative to the production of the honey-suckle or white clover, by manure, where it had never been observed before: the manure was very rich pond-mud; and the whole clover threw out remarkably thick. This is certainly a very great encouragement to the applying of good manures to grass-land. I have, likewise, observed dung well rotted to black mould, produce the same effect; but never in the degree * that the pond-mud above-mentioned did. In March 1767, I sowed a small quantity of the common turnep-cabbage in my garden; and in the May following transplanted some of the *best* plants into a corner of a field; which was dug on purpose. In June I transplanted the remaining *best* plants: leaving, in the seed-bed, only about thirty or forty plants, that did not seem worth removing. The corner of the field had been used,

* I mentioned in my note on Sir Digby Legard's observation on this fact, in the first volume of these Memoirs, an extraordinary instance of it at Kedgely-moor; and some others, which are frequent in the county of Galway. The production, without its being sown, of great crops of white clover; in places where none grew before, appears, as well from these instances as many others, I could cite, to depend rather on the quantity of manure than on the kind. As the strange spontaneous springing up of this plant, where it was before a stranger, has rarely, if ever, happened, but when manure of some kind has been used with great profusion. R. D.

for

for some years, as a stack-yard ; and was much richer than the seed-bed. Very much to my astonishment, I soon found, that the seedlings got the start of the other plants ; they were, in October, at least double the size of them. I perceive, that Sir Robert Colville has remarked the same thing in his letter to the Society. In November I put my cows, horses, and sheep, to those in the field ; they all fed upon them immediately with great greediness. I let the seedlings stand on purpose to see the effect of the frosts upon them in the winter ; and was much chagrined to find, that, in one week's time, I think in January 1768, they were all reduced to a soft pulp. The common turneps that week suffered but very little, being protected by some snow. I must conclude that the turnep-cabbage, though * a hardier plant than the tur-

* This circumstance of the turnep-cabbage suffering in a frost, which did not injure the common turnep, is somewhat singular. But the habit of plants, with relation to their tenderness, is very different in different places; even where no reason, to be collected from observation on the soil or situation, can be assigned. It is certain, that the turnep-cabbage will not endure extreme frost in general, so well as the borecoles, cole-seed, or the newly-introduced turnep-rooted cabbage. But it appears, from many years comparison, that it will, in most cases, bear, without injury, that degree of frost, which usually reduces the common turnep to a pulpy state, on the succeeding thaw : and, in some soils, it vies in hardness even with the above-mentioned plants. Sir Robert Colville found this hold good, with regard to a number of acres in the most severe weather of the beginning of the

nep, will ever be more liable to damage from the frosts upon account of their standing so much above ground: which renders a much greater quantity of snow necessary to protect them, than the turneps require. Their uprightness, however, will make them useful during a great frost or snow: as they may be easily cut up, when turneps cannot be got out of the ground without great difficulty.

A line signifying the receipt of this, will much oblige,

S I R,

Your very humble servant,

Giffing, near Diss, Norfolk,
February 11th, 1769.

EDWARD HOWMAN.

year 1768: though, in other places, I know of, as well as with Mr. Howman, few or no plants of them remained undestroyed, even on a considerable extent of land. Regard should be, therefore, had, by the former, to this local hardness of plants, in the choice of those, which he cultivates with a view of affording food for sheep, or cattle, in winter and the spring. R. D.

ARTICLE

ARTICLE V.

Further Observations on the Qualities, Culture, and Use, as well as an esculent Plant, as in Agriculture, of the TURNEP-ROOTED CABBAGE, or Cabbage-turnep, newly introduced:—and an Account of a Method of Raising Melons in Bark, without any Earth or Dung:—communicated to the Society for the Encouragement of Arts, Manufactures, and Commerce, by Mr. REYNOLDS, of Adisham; and inserted here at their Request.

To Robert Dossie, Esq.

SIR,

THE Society for the Encouragement of Arts, Manufactures, and Commerce, have directed me to deliver to you Mr. Reynold's letters, on the *Turnep-rooted Cabbage*, and his method of *Raising Melons*, in order to their being published in the *Memoirs of Agriculture*, if you think proper.

By Order,

Strand,
March 7th, 1769.

PETER TEMPLEMAN.

To Dr. *Templeman*.

WORTHY SIR,

Adisham, July 8, 1768.

ALTHO' little has been hitherto said of the use in the kitchen-garden of the turnep-rooted cabbage, be assured it is very little inferior to any other esculent plant. The herbage excels most, if not all, other greens for colour when boiled: and the roots sliced help to make rich soup, fit for the tables of princes. — A thing worthy the notice of gardeners; especially, as the greens may be cut when wanted, over and over again, as occasion requires. Such a plant was much wanted this last winter: and, therefore, this is here recommended to them; and I hope will not be despised, because the advice comes from a country farmer. I am still at a loss about the duration of this plant; whether it be biennial, triennial, or a perennial of longer continuance. The roots remain as firm as ever; and begin to shoot a-pace from those plants from which the seed has been cut off. — This being somewhat extraordinary, I thought it ought not to be passed over in silence. I have nothing further to add now, save only, that my best respects attend the Society; and I am,

Worthy Sir, &c.

JOHN REYNOLDS.

To Dr. *Templeman*.

S I R,

Adisham, Sept. 3d. 1768.

IT gives me great pleasure to find my account relating to the turnep-rooted cabbage meet with such a good reception as to merit the thanks of that Honourable Society. My present design is to give them a more full account of my practices *, relating to this most excellent plant : which, I trust, will sooner or later become very beneficial to the whole community ; and encourage every landholder, that has the means, to propagate these valuable roots.

As the meeting of the Society, I am informed, is near at hand, be pleased to lay before them for their perusal the following letter : which, I hope, will be acceptable.

My LORDS and GENTLEMEN,

GIVE me leave to say (and I do it chearfully too) that I am now able to present you with a more perfect account of the turnep-rooted cabbage, than could be done in my letter of the 13th of May 1768 †, which take as follows :

* Mr. Reynolds's former account of his first becoming possessed of the turnep-rooted cabbage, and of its culture and use, communicated by him to the Society last year, are inserted in the first volume of these Memoirs. *Article IX. p. 119. R. D.*

† Mr. Reynolds alludes here to the account, before given by him, of the consuming the product of the other part

My *first* remark relates to our spending the remains of the growth on the five acres, viz. half an acre in May *.

This very identical bit of land maintained six milch-cows, one heifer, and a young bull (in all eight neat cattle) sixteen days on the herbage part only; from which alone one hundred and six pounds weight of good butter were made, (a specimen of which butter was sent the Society.) My sheep followed the course: and the remaining roots kept one hundred and sixty-two teggs (sheep of a year old) full three weeks afterwards in the greatest † plenty. We carefully weighed

part of these five acres, in his letters to the Society, published in the first volume of his work: as mentioned in the preceding note. R. D.

* Mr. Reynolds informed the Society before, how he consumed the other part of these five acres, in his letters to them inserted in the first volume of this work. R. D.

† The cultivation of the turnep-rooted cabbage must yield great profit, if it should in general prove equally advantageous, as it appears in this half acre.—Let us suppose, in order to form a closer judgment on it, that the maintenance of every head of neat cattle, on such food, is worth one shilling per week; and of every sheep, two-pence per week, as Sir Robert Colville has stated them in his letter to the Society, on turnep-cabbage, inserted, page 418 of the first volume of these Memoirs. The value of feeding

	<i>l.</i>	<i>s.</i>	<i>d.</i>
Eight horned beasts for sixteen days will	0	18	0
then be — — — — }			
And of one hundred and sixty-two	4	1	0
sheep for three weeks — — }			
In all —	4	19	0

This

one perch, indifferently taken, before the cows were turned in ; and found the weight four hundred and eighty pounds. So that here was not less than seventeen tons of good rich food on this half-acre of land. Strange as this may appear, yet it is nevertheless true.

Second remark. — I find, by experience, these roots may be propagated with success through all the summer-months, without exception, to the great advantage of the landholder. For, so late as the 24th of August 1767, I drilled in a piece, after a crop of Reading-peas, with the seed of this plant, in two feet intervals for horse-hoeing : as has been before set forth. About Michaelmas last, we took away all supernumerary plants ; and left the remaining, for a crop, eighteen or twenty inches apart in the rows. We hand-hoed all the ground : which, being duly cul-

This is at the rate of nine pounds eighteen shillings per acre. — Let us compute further, the expence of rent of the land, plowings, harrowing and rolling, plants, planting, and horse-hoeing, at two pounds eight shillings ; which is much more than is necessary on an average of the rates in different places ; and the net profit will then be seven pounds ten shillings per acre. — This is certainly a very great gain to the farmer, who scarcely more than clears his expence by a common crop of turneps. The public would, also, if the premises should on future experience be found true in general, receive equal benefit from the extensive cultivation of this plant. As it would afford a security against the effects of very severe seasons : which destroy a considerable part of the neat cattle and sheep ; and occasion a scarcity for several succeeding years. R. D.

tivated

tivated afterwards, produced plants, the third of May, of the weight of four pounds in common; and some of five pounds weight. A few of these stood for seed: which turned out equally good in kind, as those raised in April: only with this difference, that the seed came about eight days later. This is a sufficient proof of what was before asserted; that these roots may be propagated through all the summer-months with good success; and, I may add, with good profit too.

Third remark.—Would not the man deserve ample reward, who should point out ways and means, whereby our cattle may be always fully supplied with good store of winter-food: and that of the very best kind too?

I dare venture to affirm this great good may be obtained without any extraordinary difficulties, either in labour, or expence; and yet, by means the least thought of, as I believe.—The thing lies before us, however long overlooked. It is this very identical plant, I am now treating of: which is certainly adapted for this wise purpose: and we shall see, by and by, that properly cultivated and duly managed, it will most effectually answer this most desirable *great great end*.

And here, gentlemen, let me crave your attention, whilst I unfold how this may be done, by means not founded on a chimerical notion: as may be gathered from those facts, which

which the experiments already made evince, viz.

We see it is certain, the product of this plant is very * great.

We see, likewise, with the same certainty, that the roots may be constantly raised, for any occasional supply, through all the

* On enquiring of Mr. Reynolds, how far he has found the same advantages, he here describes, attend the crops of turnep-rooted cabbage raised by him the last season, he declared himself confirmed by them in the observations here given. This very copious product is, however, doubted by some: who assert, that the crops, they have produced from his seed, have had smaller roots; and yielded much less, on the whole, than he here relates to have obtained from those he cultivated. They, consequently, infer hence, that this kind is not superior to the common turnep; though, according to his mode of culture, the expence of a crop is much greater. But no stress should be laid on the product of any plant from a few particular instances. For the effects of soil, and other incidental circumstances, are so various on many kinds of plants, especially the *brassica*, or turnep and cabbage tribe, that no certain conclusions can be drawn from single trials. Mr. Reynolds's land was far from rich: and yet the specimens he produced to the Society, verified entirely what he said of the magnitude of the roots of this plant. The herb itself, as it will bear cropping several times, affords a considerable quantity of good food: and the root is evidently more nutritive than the common turnep. The produce must, therefore, be justly supposed much greater, on the whole, on any land which is adapted to the plant: and the certainty, that the crop will not be destroyed by the most severe frost, together with its continuance, when suffered to stand, even through the whole spring as well as winter, renders this plant of great utility where there is a prospect of scarcity of pasture and fodder in the spring. R. D.

summer-

summer-months ; and may be had too in any quantity, sowing them duly.

We see, also, that the roots, when raised, are very durable : most excellent food for cattle : and not liable to be destroyed by frosts, as other greens are.

Now what more can be desired, than a skillful application in the culture ? The *materials* I will point out.

The farmer has nothing more to do than sow a little bit of land, on a gentle, good, warm soil, with the seed, about five weeks before-hand ; to be in readiness against his land is prepared to receive the plants. How to manage that has been already told. Nevertheless, as the very best methods are liable to accidents, should a second sowing be necessary, the ground is to be stirred again first : otherwise the seeds will not lie deep enough to maintain their growth. An error in this point is, by the bye, one reason, why my brother farmers often lose their turnep-crops. For it is an ill-grounded opinion, that turnep-ground should be made *fine* before sowing. As the sowing them after the plough is confirmed, by experience, to be best.

But to return.—In case food be wanting in or before December, sow the beginning, or about the 10th of April : and the plants will be ready in May for planting out.

Sow, for spring-food, as occasion may require,

quire, in any other month. Rye, peas, and white oats, generally come off in July. After any of these crops, the turnep-rooted cabbage may be planted with success assuredly, if the land be dry.

To confirm this, I have at present two very promising pieces lately planted after peas and oats. The seed, from whence the plants were raised, was sown the 15th of July last.

And we have, moreover, the experiments before-mentioned to assure us, that even sowing in drills, without transplanting, so late as the 24th of August, will succeed; and much outdo any crop of common turneps. But the other method, or transplantation, is undoubtedly best * to be pursued.

Now here is confirmation enough, with evidence, to prove, that we may always have

* The preference of transplantation of the turnep-rooted cabbage to sowing in drills, or broad-cast, and hoeing out the redundant plants, is still more confirmed, by the observations, which Mr. Reynolds has made since the date of this letter, according to the verbal accounts that he has given.—The expence of transplanting, he has below informed us, was found by him to be at the rate of seven shillings per acre, after his people were somewhat accustomed to the performance of it: allowing one shilling and six pence per day for each man employed. From these seven shillings, we must deduct the expence of hoeing an acre to thin the plants: which would of course be incurred, if they were sown where they are to stand. Hence the difference of the expence of transplantation from that of the other method appears inconsiderable; and it must consequently be esteemed the best practice, if the crop produced be materially greater from it. R. D.

a constant supply of good winter-food for our cattle in abundance, if we be so minded. And he who is negligent in procuring of it, is unpardonable (when the means are known.)

The short of the matter is this: to keep a stock of these ROOTS in readiness to set out as soon as the crops come off; or to plant on fallows: as may be most convenient to the farmer. The larger-sized plants, we find do best: the smaller are not so desirable; because the sun injures them most.

Horse-hoeing is absolutely necessary to bring the plants to perfection: as has been taught before.

I see no difficulty in the performance of this great work: nor am I aware of any objections, that can reasonably be made against it. But, on the contrary, we have the very best to hope from the fruits of our labours: and the practice of it is very natural, common, and easy to understand. The expence is little, compared with the product. For I find now my men are become expert, we can plant at seven shillings per acre: allowing one shilling and six pence per day for each man.

By this practice, the farmer runs no hazard of sowing whole fields at a venture; as he must do in turnep-culture; nor loses any crop of corn: and, what is material too, much less land will maintain the same stock, I am confident.

fidant. For one acre of these roots, that grew last year, was worth any two of common turneps; which I ever was master of, for these forty years past: and it will be allowed, that my turnep-crops have not been inferior to those of any others whatsoever in Kent.

In the case before us, we have a great deal of time for sowing and planting at pleasure: and, what is more, we have a choice of the kind of land, indeed the greatest, for this purpose. Since it is certain this plant will produce a good, nay, a great burden, where common turneps will fail; and come to nothing. This appears undeniably true from fact.

Mistake me not, however.—I would, by no means, throw the common turneps aside. They have their use truly still. But the roots, I am treating of, are greatly more copious in quantity; more firm, solid, and durable; and may be had when turneps fail. What a noble substitute then is here before us ready at hand, at all times, and all seasons too, to supply our wants, even in the most rigorous frosts.

I am, my Lords and, Gentlemen,
with all dutiful respect,
your dutiful obedient servant truly,

JOHN REYNOLDS.

Mr. REYNOLDS' New Method of Raising
Melons, as communicated to the Society.

Prepare a bed of cast tanners bark, about four feet deep, six feet wide, and twelve feet in length within-side the frame ; to be covered with four sash-lights when finished. No rain, or water, is to be admitted, by any means: for that will hinder the sweating and heat of the bark.—This bed is to be prepared about a month beforehand for receiving the seed : and March will do well for this purpose for private use. — When the bed becomes warm (which generally happens in about twenty days, or little more) a few seeds are to be steeped in a little warm milk, in a tea-cup, or small earthen vessel ; and plunged into the bark-bed for about thirty-six hours, to promote its vegetation. Then open four holes in the bed, at equal distances, of nine inches diameter, and about five inches deep : having in readiness about a peck of pounded bark (saw-dust like) to place at the bottom of the holes, three inches thick. On this place the seeds ; pressing them with the finger a little. This done, cover the seeds two inches thick with the same powder of bark, as was put at the bottom : pressing it down close with the hand. This is all that is needful to be done in planting ; and is all easy enough.

When

When the plants are advanced to a proper size, make choice of the best; and take the others away, at pleasure, as the case requires: giving them proper pruning, and as much warm air, as possibly can be, through the summer: as is done in the common methods.

By this practice, I have, for several years past, raised as good melons of divers kinds, as were ever brought to table: and that without earth, dung, or water.

I really think the fruit of the melon-plants, so managed, is better-tasted than that of those raised on stinking dunghills; and, perhaps, more wholesome too.

I have pleased myself greatly by this new method; and flatter myself, it will meet with a candid reception among the learned sons of agriculture, gardeners, &c. for whom I entertain a great veneration.

P. S. The glass-frame is to be covered at nights, and in cold days, with a matt during the cold seasons.

N. B. By this method we are not annoyed by any worms, snails, or insects whatsoever: which is more than can be said for the common practice.

ARTICLE VI.

Account of Experiments, to determine the comparative Advantages of the Drill and Broad-cast Husbandry; communicated by Sir DIGBY LEGARD to the Society for the Encouragement of Arts, Manufactures, and Commerce, and inserted at their Request.

To Robert Dossie, Esq.

SIR,

THE Society for the Encouragement of Arts, Manufactures, and Commerce, have directed me to deliver to you Sir Digby Legard's Comparative Account of the Culture of Wheat, in order to its being published in the Memoirs of Agriculture, &c. if you think proper.

Signed by Order,

PETER TEMPLEMAN.

The

The following EXPERIMENTS on the Cultivation of Wheat, are humbly offered to the Society for the Encouragement of Arts, Manufactures, and Commerce.

AS a candidate * for the honorary premium offered by the Society, for an account of the most profitable method of cultivating wheat, I here send you this year's experiments on that grain, together with the history of the actual produce of several fields sown, in different years, on various soils, and in three different methods: viz. Broad-cast; —drilling in equidistant rows; — and drilling on beds, horse-hoeing the intervals.

In the last method, the land is plowed into ridges of about five foot broad. Two rows, or more, are drilled on the summit of every ridge; and the intermediate space, or interval, betwixt each pair of rows is left unsown, to admit of the plow, or horse-hoe. Thus the land is tilled, whilst the crop is actually growing: and, by this tillage repeated often, and at critical times, it is intended, that the roots of corn, &c. may be enabled, without dung, to find a supply of food requisite

* The premium, claimed by Sir Digby Legard, for this account, was the gold medal of the Society: which was unanimously adjudged to him. It is the second obtained by him, for communications on this subject: the former particulars of which are inserted in the *first volume of these Memoirs*. R. D.

to the perfection of the plants. — But this is not the only advantage proposed. — All kinds of weeds, that grow in the intervals, are to be ploughed up before they have time to exhaust the land, or shed their seed:—the small places betwixt the rows are to be hand-hoed:—and the rows themselves weeded. A proper instrument sets the seed-corn at the depth required; and in any desired quantity: by which regular distribution, a third part of the seed, used in the common way, is sufficient to sow an acre in this: and it is presumed, that the wide intervals of four feet, by the free admission of the sun and air, enable the stalks to grow stronger; and the grain to ripen more perfectly. It is further asserted, that this mode of culture does not exhaust the land:—that the soil is kept in heart as well as in tilth:—and that, without manure, wheat may succeed wheat in infinite succession.

The method of drilling corn in equidistant rows, without any intervals for horse-hoeing, is a middle way betwixt broad-cast sowing, and horse-hoeing. The benefit intended by this method is directed to the saving of seed, half the usual quantity being sufficient;—the distributing that seed more regularly, both as to depth and distance;—and the admitting of hand-hoeing: a very useful operation; and which the regularity of the rows, in this mode of culture, makes quite convenient.

The

The methods of broad-cast sowing are various; but too well known to need any particular description. Wheat is sometimes sown under furrow, and sometimes harrowed in. It follows clover, beans, or peas, &c; or is sown on fallow, just as it may suit the land, or the convenience of the occupier. But, unless the soil be extremely rich, it requires a great quantity of manure, as well as a perfect tilth.

As wheat occupies the land longer than other grain, it naturally requires a larger supply of nourishment: and, being the best in quality, and most costly of all grain, no farmer grudges to bestow his best land, his richest manures, and his utmost care upon it.

One of those three methods, above described, of cultivating wheat, is probably the best.

But as there are advocates for each, and the debate is very interesting, I have postponed giving you my sentiments on this important subject, till, by reason, observation, and experience, I might be enabled to offer something precise, and determinate. Having, however, now had several years practice in the drill-culture, I send you the result of that practice, as far as relates to the cultivation of wheat, extracted from my minutes: and, to avoid the imputation of partiality to a favourite system, I must premise, that, during the ten years, I have pursued the horse-hoeing culture, I have constantly attended the common

mon method; and have generally even practised the latter on fields contiguous to those destined for the Tullian, or garden-cultivation. True it is, that where the new method is carried on in a neat, and husband-like manner, the fields resemble a garden in the elegance of their appearance, and the luxuriance of their productions. Whether, or no, the preference be really due to this system, or it ever will be generally adopted, time and experience must discover. All the light, we can reasonably expect in this dark subject, the Society has wisely given, by calling for a comparative view of the advantages and disadvantages attending each peculiar method of culture, confirmed by experiments. By those, which, I am about to relate; and in which I shall be careful to remark every striking circumstance, it will appear to which method, I give the preference. I propose to state the expence and profit of each; and, after every experiment, to add such observations and reasonings, as naturally occur. If, upon the whole, the new husbandry should appear, from my experiments, to be most advantageous; yet, in different soils, situations, and circumstances, others may be in the right to prefer the beaten roads: and even taste will influence many, to pursue the same end by different means. Farmers are induced to continue the routine of random sowing; whilst gentlemen

men adopt the more elegant entertainment of a garden culture: the first, content to tread the dull round prescribed by their forefathers; the last indulging their fancy in a more pleasing variety. Nor is it unjust, that the most sure and even road should be trod by the industrious husbandman, on whom, both his own family, and the nation, must depend for bread: whilst men of fortune, in the pleasing, but dangerous avenues of experiment, are sometimes mortified with disappointment, and loss; or, at other times, elevated with uncommon success. And, as gentlemen are the most proper to make experiments, so are they most likely to strike out capital improvements: which, when sufficiently established by long and constant success, ought then, and not till then, to become the universal practice.

Tull was the first, in this country, who introduced, and continued in an extensive manner, the scheme of sowing corn regularly in rows; and tilling the land within reach of its roots, in order to encrease its growth. His idea was sensible; and was found to answer in practice. His scheme gains ground in several foreign parts: but, though many have tried it here; and even approved it; yet few, if any, have had the resolution to persevere. But I flatter myself, that the following experiments, which are no more than a plain relation of facts, will evince the reasonableness
of

of the scheme, and the great advantage attending it.

On the 8th of October, 1758, one acre was drilled with common white wheat, called Lammas, on ridges five foot broad. A double row was sown at the top of every ridge: the partitions being eleven inches. Consequently, the intervals for horse-hoing were four feet one inch. The seed was moistened, and limed: and the quantity used was about two pecks. The plants were hand-hoed once; and horse-hoed three times: and the produce, when thrashed, was one quarter, four bushels.

OBSERVATIONS on the above EXPERIMENT.

The field, in which this corn grew, is an inclosure of about sixteen acres, and nearly square; tolerably well sheltered, particularly on the east-side, by trees and hedges. The ridges run east and west. The soil is light, dry, deep, and friable: about six inches of soil have been usually stirred with the plough. This soil is a hazle mould, accounted good barley land; but scarce strong enough for wheat. This field, whilst in grass, was rented at sixteen shillings per acre; but is no better than the neighbouring fields in tillage, let for twelve shillings. I have been the more particular in the description of this soil, &c. because

cause several more of the experiments, which follow, were made therein : and I think it highly necessary, that every circumstance of that kind should be carefully attended to. This acre had borne three successive crops, viz. first, oats, on once ploughing the swarth or sod : secondly, barley, on two ploughings : (N. B. The two last crops were very good ones, and were sown broad-cast :) thirdly, peas drilled, and horse-hoed ; which was also a good crop. The fourth crop, being wheat, as above related, and producing one quarter four bushels, cannot be esteemed a bad one : but it would have proved better, if rightly managed. One fault committed was the sowing too little seed : which was occasioned by the lime's * clogging the notches of the spindle of the drill. Tull's last-improved two-wheeled drill-plough is the instrument, I generally make use of : and, I think, three pecks to an acre is the least quantity of seed required. The expence, and profit on one

* The method of brining wheat, with a solution of common salt and lime, communicated to the Society for the Encouragement of Arts, &c. and inserted below in this volume, perfectly answers the end of liming ; and avoids that very great inconvenience in drilling, which attends the use of lime in substance. The clogging the instrument, as here mentioned, by lime, has been one very strong impediment to the success of experiments on the drill-culture. As it necessarily prevents the equal deposit of the seed in the furrow : on which, in a material degree, the quantity of corn produced, depends. R. D.

acre

acre of horse-hoed wheat, so cultivated, will be nearly as follows :

	£.	s.	d.		£.	s.	d.
One ploughing from the ridges, — — —	0	4	0	One quarter four bushels,	3	0	0
One hand-hoeing, — — —	0	2	6	product, at			
Three horse-hoeings, at	0	3	6	5s. per bush.			
1s. 2d. each, — — —	0						
Three pecks of seed, at	0	3	9	Deduct ex- pences — —	1	9	9
1s. 3d. per peck, — — —	0						
Drilling *, reaping, and carrying. — — —	0	4	0	Remains clear	1	10	3
One year's rent of one acre,	0	12	0	profit — —			
	1	9	9				

* It has been usual to omit the expence of reaping, and carrying home the corn, in these accounts ; because the value of the straw, which is also omitted in them, is supposed to counter-balance those articles. This expence is, however, charged here, without any allowance, in the account of produce, for the straw. There is not, however, the least impropriety in so doing : as this state is given with a view only of making a *comparative* estimate of the profit in the three modes of cultivation : and the same omission is made in the charges of product respecting all of them : which renders the matter equal as to the *comparison*. But, as the value of the straw is a real part of the return, it is proper to allow for it, if no equivalent set off be made in the expences, when a computation is made of the *absolute* profits of any of the three modes of culture. To apply this to the drill-husbandry : if we allow three shillings for the straw, a drilled acre according to the result of the experiments before us, will afford one pound thirteen shillings and eight-pence clear profit : which furnishes an additional encouragement, to the use of the drill-method, that renders the constant cultivation of wheat on the same land practicable. R. D.

On

On the 25th of October, 1759, four acres were drilled with common white wheat, on five foot ridges, in eleven partitions, in the same field, after a crop of barley; and took one bushel and three pecks of seed, managed as before related. The produce was four quarters five bushels. This was a poor crop: owing chiefly to too late sowing, and using too little seed. The season being so far advanced, four pecks to an acre would not have been too much. The plants stood very thin in the rows. The hand-hoeing was not performed with care: and the fourth horse-hoeing was omitted; whereby many weeds sprung up to the detriment of the crop. This was the second successive crop.

The same four acres were again drilled with wheat in the beginning of October, 1760, managed as before-mentioned, and two bushels of seed was sown: which yielded seventy-six stocks; or five quarters three bushels. This was the third successive crop: and the produce was twenty-one fold.

It may be observed, that the crops of the two last experiments were inferior to the first, although raised in the same field, and where the soil was equally good. The reason, I have in part given. Moreover, the seasons were not quite so favourable.

It cannot be urged, that the riches of the soil were exhausted: because the four acres in question do not comprehend that

particular acre, first-mentioned. Besides, the last crop was better than the preceding one, on the same land. Every farmer knows, that some years are particularly favourable for wheat: and that other years are averse. Yet every one may not be able, to assign the direct causes of each year's failure, or of each year's success. Manifest inclemencies of seasons, such as hurricanes, &c. are obvious to every eye: but there are unseen and secret causes, that operate towards the destruction of crops; which are not the less sure for being unnoticed. The worm, which preys upon the root, is an enemy of as much consequence, as the bird, which devours the ear. An open attack is less dangerous than a secret conspiracy.

October 1761, three acres three rods, part of the same land, was again drilled with wheat; and, in like manner, hand-hoed, and horse-hoed as before. The quantity sown was two bushels. Seventy-two stocks were reaped: which yielded five quarters. This was the fourth successive crop: yielding twenty fold.

Some of the same faults were committed now as before. The chief was dispensing the seed too sparingly. This would have been prevented, if I could, myself, have attended the operation of sowing.—The ground was under-stocked with plants of wheat: and, in their room, the weeds intruded themselves: which

which exhaust the moisture, and rob the useful plants of nourishment. This crop was nearly of equal goodness with the preceding.

February the 26th, 1763, one acre and half was drilled with wheat on one ploughing, after a crop of turneps, which was eaten off by sheep. The beds were hoed as usual: the quantity of seed sown was four pecks: which was first steeped for thirty-six hours in salt and water; and limed. The produce, when threshed, was one quarter two bushels. This was a poor crop: as spring-wheat generally is. However, it was the fourth successive one: yielding ten-fold.

In October 1763, five acres, one rod, twenty-four perches, were drilled in the same manner with wheat; and took a somewhat larger allowance of seed, viz. three bushels, three pecks. This corn was managed as usual; cut the 26th of August, 1764; produced one hundred and twelve stocks; and when threshed, yielded nine quarters six bushels. It was the sixth successive crop. The ears of this corn were remarkably large, and well filled with grain; and contained, at a medium, forty grains in each ear. The rate of increase was above twenty fold.

September the 19th, 1764, seven acres were drilled on the same land, in the same field. Six bushels, two pecks of seed, were used: which produced ten quarters. The rate of increase here was nearly thirteen fold; and

the seventh successive crop. Part of this field was drilled with my own wheat, which grew on the same land; and part with the wheat produced from a strong clay, at a distance. Part of the seed was limed; and part unlimed. But I could not perceive any material difference, either in the growth, or produce, betwixt one part and another. A bushel of this corn weighed, in January, sixty pounds.

In October, 1765, the same seven acres were again drilled with wheat as above; took five bushels three pecks; and yielded six quarters five bushels: or above ten fold. This was the eighth successive crop. But this year was bad for wheat: and the drilled crops shared the fate of others.

On the 18th of September, and 22d of October, 1767, seven acres and a half, in the same field, were drilled again with wheat, as before; and took seven bushels of seed: six of which were white lammas, from a strong clay at twenty miles distance: and one bushel was Smyrna wheat; otherwise called Sicilian, or cluster-eared. The repeated hand, and horse-hoeing, had the usual effect on this crop: viz. to make it branch greatly; and to render the plants of a deep green colour, strong, and vigorous; and the ears large, full, and heavy. The quantity of seed proved sufficient: whereby the whole field was completely stocked: and, the season proving kindly, this crop was perfectly beautiful, free from weeds,

weeds, and of a most promising aspect: all, except the one acre and half of Smyrna wheat. The seed there had not been good: and too little of it had been sown: wherefore it stood much too thin on the ridges. In other respects, the plants were extremely fine; and the ears well filled; and it ripened perfectly. N. B. This acre and half had been dunged the year before. This crop was cut, and led in the beginning of September last; and produced as follows: viz. six acres of white wheat, which took six bushels of seed, produced one hundred and nineteen stocks: or nine quarters three bushels. The acre and half of Smyrna wheat, which took one bushel of seed, produced twenty-two stocks: or one quarter, five bushels, two pecks. The white wheat is remarkably clean, fair, and plump: and the bread, &c. made of it, which have been constantly used in a large family for some months past, have been acknowledged of the very best quality. On the contrary, the Smyrna wheat, though the ear contain more grains, and those are larger, yet the bread is much inferior: being neither so light, nor fair. The miller, however, observed, that this corn yielded more flour than the common sorts: but it was gritty to the touch: as the grain was remarkably hard. Possibly the common mill-stones may not have power to grind it perfectly. This being my last experiment in the hose-hoeing method, I must

remark, once for all, that every crop, except the acre and half of Smyrna wheat, was raised without dung: nor was that acre and half dunged for wheat; but for the preceding crop: part of the land being of very inferior quality. Most of these crops succeeded each other on the same land: and the last was the ninth. I expected, indeed, a greater increase: but a good deal has been wasted, by rats and other vermin. However, the rate of increase is about thirteen fold from the common wheat: and one quarter four bushels, two pecks, to the acre; and above ten fold from the Smyrna wheat; or one quarter one bushel three pecks per acre. N. B. The same land is again drilled with wheat, the tenth successive crop.

EXPERIMENTS on *Wheat drilled in equidistant Rows.*

October the 9th, 1762, four acres and a half were drilled with wheat in rows, one foot distant and no interval, on one ploughing after clover. The second crop of clover on half this land was plowed in: and the remaining half was well-manured, viz. twenty loads of dung to an acre. The seed was steeped twenty-four hours in sea-water; and then limed. The quantity sown was four bushels two pecks. The whole of this land was hoed the following spring: which was
of

of manifest advantage to the crop. But the dunged and undunged parts seemed of equal goodness. This corn was threshing in February, 1764; and produced seven quarters six bushels, one peck: which is nearly one quarter six bushels, to an acre, or nearly thirteen fold.

The Expences here are as follows, viz.

	£.	s.	d.
Forty-five load of dung, at 2 s.	—	—	4 10 0
Value of the second crop of clover ploughed in	1	2	6
One ploughing, at 6 s. per acre	—	—	1 7 0
Four bushels two pecks of seed, at 5 s. per bushel	—	—	1 2 6
Harrowing and reaping, at 6 s. per acre :	—	—	2 9 6
hand-hoeing, at 5 s. per acre	—	—	0
Rent of four acres and half, at 12 s. per acre -	2	14	0
	13	5	6

	£.	s.	d.
The value of seven quarters six bushels one peck, at 5 s. per bushel, is	15	11	3
From which if we deduct the expences	13	5	6
	2	5	9

which is 10 s. per acre, net profit.

October the 20th, 1764, two acres were sown by hand with white wheat: viz. an acre and half on a rich old pasture, on once ploughing the sod: and half an acre on wheat stubble. The seed used was four bushels two pecks. At the same time, three acres adjoining were drilled in equidistant

F 3

rows

rows one foot asunder ; and took four bushels one peck. The preceding crop was oats ; and the land was twice ploughed since harvest, to destroy the scattered seed.

		q.	b.	p.
The two acres sown by hand, yielded	—	5	2	2
The three acres drilled in equidistant rows, yielded	—	8	7	3

		q.	b.	p.	
The former is	—	2	5	1	per acre,
The latter is	—	2	7	3	per acre

		£.	s.	d.
Value of the crop on the three acres, sown	}	—	—	—
by hand, at 5s. per bushel				
Deduct for seed, expences, and rent	—	—	—	—
		—	—	—
Profit	—	6	16	0

Value of the crop on the three acres drilled in	}	—	—	—
equidistant rows				
Deduct for seed, expences, and rent	—	—	—	—
		—	—	—
Profit	—	12	10	6

REMARKS on the above.

The seed of the drilled part was not limed : but I could not perceive any inconvenience from that omission in this experiment. Yet, at other times, I have thought the crop has suffered by being unlimed ; either from the seed's being unprotected from vermin by a superficial covering ; or by being more liable to smut.

Though no manure was actually used in the above experiments, the land being fresh, and in good heart, it will not be unfair to charge

charge something on that account. Because this crop of wheat (a large one), exhausted the land; and made it absolutely necessary to use manure for the succeeding crop of barley: which a horse-hoed crop would not have required. I, therefore, must deduct for the value of fifteen load of dung to an acre: and then the net profit

	£.	s.	d.		£.	s.	d.	
On the two acres sown								
in broad cast, is	3	16	0	or	1	18	0	} on each acre.
On three acres drilled,	8	0	6	or	2	13	6	
net profit	—	—	—					

September the 1st, 1764, two acres and a quarter of poor land, but fresh, and limed with one chaldron to an acre, having been thrice ploughed after oats, were drilled with wheat in equidistant rows; and took four bushels of seed. The produce was three quarters five bushels.

This was a middling increase, being about seven fold.

	£.	s.	d.	
The value of this crop is	—	7	10	0
The expences	—	6	0	0
The net profit	—	1	10	0
The net profit is here	—	0	13	0 per acre.

In October 1766, two acres and a quarter were sown in broad-cast, on clover-stubble, with five bushels two pecks of seed; and yielded, in Sept. 1768; seventy-four stocks of corn. Each stock produced a bushel of wheat:

which is above four quarters to an acre. I have this account from a neighbouring farmer, who sowed this wheat on his best land: and he assured me, this was the largest crop that ever grew on it. He used twenty load of dung to an acre.

	£.	s.	d.
The value of which was	—	—	4 10 0
Seed, ploughing, weeding, reaping, and rent	—	—	4 10 0
			9 0 0
The value of the crop	18 l.	10 s.	Ex-}
pences 9 l.	Net profit	—	—}
			9 10 0

The acreable produce is four quarters. The rate of encrease is twelve fold. I shall here end my account of experiments: and, before I proceed with my observations thereon, I cannot help remarking, that were the comparative advantages of the drill, and broadcast husbandry, to be estimated on the footing of this crop of wheat, the scale would undoubtedly preponderate in favour of the common method.

I have always been of opinion, that no single crop of horse-hoed corn, could stand in competition with a field in broad-cast. But it is not our business to examine the partial advantages of a single year; but the real advantages of a course of tillage, extended to four or five years; and the preference is, surely,
due

due to that method, which, at the end of such course, yields the finest and most corn, obtained at the least cost.

By way of recapitulation, I here give, at one view, a table of the experiments.

NEW HUSBANDRY.

Years.				Seed sown.	Produce.			Rate of encrease.
	A. R. P.				Q. B. P.	Q. B. P.		
1758	1 0 0	Wheat horse-hoed	-	0 0 2	1 4 0	24 fold		
1759	4 0 0	Ditto	- -	0 1 3	4 5 0	20 fold		
1760	4 0 0	Ditto	- -	0 2 0	5 3 0	21 fold		
1761	3 3 0	Ditto	- -	0 2 0	5 0 0	20 fold		
1763	1 2 0	Ditto sown in Feb.		0 1 0	1 2 0	10 fold		
1763	5 1 24	Ditto sown in Oct.		0 3 3	9 6 0	20 fold		
1765	7 0 0	Ditto	- -	0 6 2	10 0 0	13 fold		
1766	7 0 0	Ditto	- -	0 5 3	6 5 0	10 fold		
1767	6 0 0	Ditto	- -	0 6 0	9 3 0	13 fold		
1767	1 2 0	Ditto Smyrna wheat		0 1 0	1 5 2	13 fold		
41 0 24				3 6 1	55 1 2			

OLD HUSBANDRY.

				Q. B. P.								
1762	4	2	o	Drilled in equi. rows	o	4	2	7	6	1	13 fold	
1764	2	o	o	Sown broad-cast	-	o	5	o	5	2	2	8 fold
1764	3	o	o	Drilled in rows -	-	o	4	1	8	7	3	17 fold
1765	2	1	o	Drilled in rows -	-	o	4	o	3	5	o	7 fold
1767	2	1	o	In broad-cast -	-	o	5	2	9	2	o	12 fold
14 o o					12	7	1	34	7	2		

q. b. p. acres q. b. l. s. d.
 34 7 2 being the produce of 14, is near 2 4 per acre, worth 5 0 0
 55 1 2 ditto - - - - 41, ditto - 1 3 ditto, - ditto - 2 15 0

As, from the above experiments, we have been able to obtain the medium acreable produce, both in the old and new husbandry, I shall in the following calculation state the crops

crops in each according to those data. And I am confident, that, in so doing, I give an advantage to the old method, which it is not entitled to. For I have mixed the accounts of crops drilled in equidistant rows, with the crops in the old husbandry; of which, in fact, they are no part. Now that method of sowing both takes less seed; and constantly produces a greater crop: nor do I think that the medium acreable produce would be so great otherwise. Therefore, if, by this comparison, the new husbandry proves most advantageous, there is no doubt but that, in other cases, it will prove still more so.

I state the standing expences on one acre of horse-hoed wheat at one pound eight shillings; and the expences on broad-cast, of the four several years of the course, according to the price of labour and manure in these parts.

DRILL HUSBANDRY.

BROAD-CAST HUSBANDRY.

Y.	Acres.	Pro-duce.	Ex-pences	Net prof.	Y.	Acres.	Pro-duce.	Ex-pences	Net prof.
		q. b. p.	l. s. d.	l. s. d.			q. b. p.	l. s. d.	l. s. d.
1	1 Wheat	1 3 0	1 8 0	1 7 0	1	1 Wheat	2 3 3	3 9 0	1 10 0
2	1 Wheat	1 3 0	1 8 0	1 7 0	2	1 Turneps	35 tun	3 0 0	0 0 0
3	1 Wheat	1 3 0	1 8 0	1 7 0	3	1 Barley	4 0 0	1 8 0	2 12 0
4	1 Wheat	1 3 0	1 8 0	1 7 0	4	1 Clover	3 tun	1 0 0	0 10 0
4	4	5 4 0	5 12 0	5 8 0	4	4		8 17 0	4 12 0

I appeal to common experience for the truth of the account above, in common practice;

tice : and the soil in question being peculiarly adapted to turneps, and clover, makes the common husbandry more profitable here than in many other places, where stiff clay, or poachy ground, might make it inconvenient to adopt the turnep culture : in which case a fallow every fourth year, at least, would be attended with nearly the same expence, without any, crop to repay it : and this soil being too light for wheat, I should think, a horse-hoed crop of it would succeed better in a rich loam, or even a strong clay.

ARTICLE VII.

Three Accounts of the Cultivation of Burnet, and its Utility in feeding Sheep, and Horses: the first by Mr. JARVIS, who sowed it with Barley, and alone ; — the second by Mr. SISSON ; — and the third by ROBERT BARBER, Esq. who has added some Observations on the Turnep-Cabbage, and Anjou-Cabbage: the whole communicated to the Society for the Encouragement of Arts, Manufactures, and Commerce ; and inserted at their Request.

To Robert Dossie, Esq.

SIR,

I Am directed by the Society for the Encouragement of Arts, Manufactures, and Commerce, to deliver to you Mr. JARVIS's and Mr. SISSON's Accounts of Burnet ; and Mr. BARBER's Letter on Burnet, and different sorts of Cabbage ; in order to their being published in the Memoirs of Agriculture, if you think proper.

By Order,

Strand,
March 7th, 1769.

PETER TEMPLEMAN.

To Dr. Templeman.

SIR,

HEARING an extraordinary account of burnet, early in the spring, 1766, I bought seven pounds of it: one pound of which, I sowed in several kinds of soil. In all of them it grew very well.—The remaining part of it, I sowed upon a rod of land at Midsummer following. The land had been ploughed three times; and made very clean. The other part of the close was sown with turneps. The turneps and burnet were kept very clean and free from weeds. There was a good crop of both. In November, I put in nine of my worst lambs, in order to keep the close clean. They eat the burnet before any thing *. I permitted them to do it:

* Notwithstanding the readiness with which, Mr. Jarvis thus found his sheep and lambs eat the burnet; and of which there are many other instances; yet there are particular places, where, from some hitherto undiscovered quality of the soil, it is rendered so disagreeable to sheep, as well as neat cattle, and horses, that either all absolutely refuse it, or only some few can be reconciled to its flavour, particularly while, it is strong and luxuriant. It is, therefore, proper to intimate, that some experiment should be made on this point, before the engaging in the cultivation of burnet, on any considerable quantity of land. The same caution has been before given, in the first volume of this work: but it cannot be too often inculcated, where the facts presented might induce those, who are not apprized of this limitation of them, to incur the danger or loss, which may be prevented by a previous trial. R. D.

and

and they throve much better than the lambs on the turneps. In my opinion, an acre of burnet will yield more fodder than an acre of turneps; and will keep stock longer, and better. About Christmas, a very deep snow fell; and continued upon the ground for three weeks or more. When the snow was gone, the burnet looked very hearty; and was fit to turn cattle in again. But, being desirous of sowing some more, I let it rest till a week before Midsummer: and then I mowed it. It produced a great quantity of seed; but the weather was so very bad, that it lay thirty days. I was obliged to turn it often; which occasioned a loss of more than half the seed. But I found it weighed ninety-four pounds. The herb of it was so decayed and rotten, that no cattle would touch it: the swarth being so long upon the ground; and the weather proving so wet. The grass lying so long, prevented my having a second crop of seed. I have put sheep into it a second time: and they eat it greedily, as before; and thrive much: so that I shall lay it for seed next summer. Being much pleased with my last year's burnet, in the spring, 1767, I prepared another parcel of burnet-seed, in order to try experiments. In March, I sowed a rod of land, next to the first, where the turneps had been eaten off, and the land broken up for barley, with burnet alone. The rest of my seed, I sowed with barley. The rod of land,
I sowed

I sowed with burnet alone, was so full of weeds, it was a great expence to me, to keep it clean. That sown with barley, had a full crop of barley: and, in my opinion, promises to be as good as what was sown alone. The expence of weeding, and loss of crop, make a great difference. So the best way * of sowing burnet is with a crop of barley, or oats, in March. Burnet is an exceeding fine pasture for sheep. I have observed the seed to lye upon the ground untouched by the birds: and, when rain comes, it will grow, though not covered before the rain. After the first year, it requires no weeding; but must be weeded several times at first. My

* As it appears by these trials, that burnet may be sown with barley and oats, without any injury to the crops of them; or suffering by them, as to its own produce; but, on the contrary, is kept, by this means, much more free from weeds; it opens a very profitable method of procuring a quantity of excellent winter-food for sheep, or occasionally for neat cattle, without any additional expence, but the price of the seed: which, to those, who raise it themselves, is almost nothing. If burnet be thus sown, along with barley, on lands intended the next year for lea, or turnep-fallow, it may, after being eaten in the winter, and spring, by sheep, or lambs, be plowed in at the time it ceases to be wanted; and being effectually buried by a good drench-plow, will, together with the dung of the sheep, be of great benefit; and spare a considerable part of the manure, that might otherwise be requisite.—There are other applications, which this practice admits of, that may afford great advantage, in particular cases, as well as where the burnet is designed to be continued to grow as a pasture-grass. R. D.

cattle

cattle eat it at all times of the year, whenever I tried them. As to the value of the land, before it was plowed, I rented it several years at five shillings per acre. The quantity sown upon a rod was six pounds. These are such observations as I have been able to make upon burnet. If you think, they may be any ways useful to the public, they are entirely at your disposal.

I am &c.

December 17, 1769,
Little Casterton, Rutland, near
Hamford, Lincolnshire.

JOHN JARVIS.

GEORGE SISSON of Bridge-Casterton, in the county of Rutland, farmer, did, in May, 1767, sow, upon one acre of creech-land, in Ingthorpe lordship, in the same county, properly cultivated as for turneps, fourteen pounds of burnet, in an inclosure, which was sown with turneps cultivated in the same manner. After the turneps were sown, the burnet was laid; and not meddled with till the time the turneps were stocked for eating off: which was in March 1768. The burnet grew to about eighteen or twenty, and some about twenty-two inches in length: having received no damage by the inclemency of the weather: although, the turneps rotted greatly. And, I verily believe, it did as much service to the sheep, as the best acre of turneps in the ground. The sheep
being

being remarkably fonder of the burnet than the turneps, I was under a necessity of eating the burnet till all the turneps were eaten off; and the turnep-land sown with barley; which was the first week in April, old style. The burnet grew; and was a tolerable good crop, to all appearance; but, being a stranger to it, I believe it stood two or three days longer than it ought. It began to shed very much, as I mowed it; which was in the beginning of July: but, the weather being favourable after it was mowed, prevented its shedding much from that time. When it was properly in order, as hay, or saintfoin, I carried it into a barn; and threshed it out: and, to my astonishment, when winnowed, there were twenty-three bushels*; or two quarters and

* Twenty-three bushels of seed from an acre of burnet, though it seemed an astonishing produce to Mr. Sisson, is yet but a small crop. It appears from the account given by Mr. Lamb, to the Society for the Encouragement of Arts, Manufactures, and Commerce, and quoted in a note, page 207, of the first volume of this work, that an acre of burnet will afford ten quarters of seed from two crops taken together, which may be had in one season. He found his horses eat this seed very readily; and imagined it as good for them as oats: but it were much to be wished, that more conclusive experiments were made of its effects in feeding horses, neat cattle, and hogs. For full crops of it might be obtained after the herbage had been eaten off by sheep, or neat cattle, at any time from the middle of October to the middle of March. The double advantage of its answering both the purposes of grass, and corn, would render it very valuable. R. D.

seven bushels, that weighed five hundred sixty-two pounds and a half, neat seed from fourteen pounds only; which was sown. The fodder, the horses eat much like the saint-foin, after it was threshed.

N. B. The fourteen pounds I sowed the acre with, cost me seven pence halfpenny per pound; which amounts to eight shillings and nine-pence: and the five hundred and sixty-two pounds and half, after the same proportion, amount to sixteen pounds eleven shillings and six pence halfpenny. This being my first experiment of the burnet-grass, the good success I had, will induce me to make a further experiment. I intend (God willing) to sow twelve acres of land in the same lordship, (properly cultivated) in March 1769, with a crop of barley, in order to find out the best and most advantageous method of dealing with the said seed; and shall endeavour to introduce it in another lordship in the same county: and others of my family intend doing the like upon different soils.

Bridge-Casterton,
Aug. 1st, 1768.

Witness my hand,

GEORGE SISSON.

N. B. Mr. John Jarvis of Little-Casterton, in the same county has tried the same experiment, with the like success.

SIR,

SIR,

INCLOSED you receive an account of burnet sown by me in the year 1766. The yearly value of the land, on which it is cultivated, is not mentioned in it: as it hath not been rented for some years: nor is the specifying that particular, I think, required in the advertisement for burnet sown that year. In my own opinion, however, several acres of this land were not then worth three shillings per acre, per annum: and the whole number of acres, one with another, not more than six shillings per acre, per annum; but they are now really worth twenty shillings per acre, per annum, at the least computation; and the land improves in value every year, by sheep feeding on it, and the falling out of the burnet-feed. I observe, by the feeding of it with sheep, the ground fills naturally, with the native trefoils: which makes a very sweet and improving pasturage, that the sheep feed much on, before they eat the burnet. When the burnet is in its luxuriant sap and growth, in the heat of the summer, sheep are not then fond of it: but they will feed on it well later in the summer, when the sap is declined, and the herb not so strong, in smell or taste. I must further observe, that sheep brought from sweet trefoil-pasture, do not relish the burnet until they have eaten the sweet grass, that may grow amongst it. But my ewes,

G 2

that

that have fed on it for two years past, will feed on it at any time in the summer: and sheep, bred on it, naturally feed on it better than others; and, by nibbling it with the other natural grass, soon relish it. Sheep prove well, that feed on burnet. It is a healthy sound grass; always in sap; and greatly beneficial to a stock of sheep in the spring-time, when there is no other grass.

I believe burnet will prevent the rot in sheep: of which I shall next year send an experimental proof; as also a full, ample, and experimental account, of burnet sown in with wheat, barley, summer-vetch, buck-wheat, trefoil, and cow-grass: and on the grass sward. As also, of the different soils, culture, and season of the year, when it was severally and respectively sown. I sowed in the year 1767, with burnet, about forty-five acres: and, in this present year, 1768, I sowed about sixty acres. From the observations, and experiments, I have made on sowing burnet, I yearly improve in it: as I am thereby better acquainted with the soil; culture; the several times of the year for soing it; what grain it may be sown with; the times of the year for mowing, feeding, feeding, and laying it up; and all other requisites to give burnet its real utility and value. Of these I shall be always ready to inform the Honourable Society, before the account, I shall send, for the year 1769.

I did

I did not sow any turnep-cabbage, this year: though I had some bushels of seed, of the produce of the year 1767, of which I omitted sending an account to the Society. But I have several plants of it in my garden, from seed which fell out: one of which, of the round sort, is very large. I find they vary much in their form. I have of the oblong sort; and several of a stem of a foot and a half long; swelling or forming bulbs near the head of the stem. This last sort is of the red species; and more apt to * suffer by the severity of the winter, than the low-rooted sorts. I have collected seed of four sorts of them, and am trying, by planting together the several sorts of them, intermixed with the Anjou, Jermin, or Jerusalem, and others, to see what effect they will have by their respective farina on each other: of which effects I have already seen some variation, from experience.

* This deviation from the general figure of the turnep-cabbage, into a long stalk with an oblong enlargement, in the upper part, instead of the globular bulb-like enlargement near the bottom, seems to be the consequence of a degeneracy of this plant, by a mixture with the common kinds of cabbage: the *farina* of which might easily have had access to the plants, that produced this seed as they grew in a garden. The same supposition accounts for their being tenderer than such plants of the turnep-cabbage, as preserve their original manner of growth: as the common cabbage is less hardy than this kind. R. D.

I find the Anjou cabbage to be preferable to any other; both for the garden and field use: as it is a very quick-growing plant; stands the severest winter; produces a succession of a great many sprouts in the spring; eats very finely; and, after repeated gatherings, produces a great quantity of seed. This I experienced last year: and had some plants above eight feet high. They were large in their stalks: and were supported with large stakes. There are three sorts of it. I must, also, observe, that the turnep-cabbage, both root and green, when young, is most delicate, for its sacchrine juice and flavour: which I now experience to my great satisfaction.

I am, &c.

Nov. 23, 1768.

ROBERT BARBER.

To the Honourable Society for the Encouragement of Arts, Manufactures, and Commerce, at the Society's Office, opposite Beaufort Buildings, in the Strand, London.

BURNET seed sown on the estates of Robert Barber, Esq; called by the names of Southway Bond-house, and Pound, situate in the Parish of Whetstone, in the county of Devon, about four miles from the city of Exeter.

Upper Down was sown in June 1766:—
Goldimore was sown in August 1766:—the
soil

soil of the above two fields is mostly of a gravelly, poor, loose nature ; not deep in the surface : some part of it of a cold clayey bottom ; but mostly of what they call here, a shillack ; or loose stony and flaty bottom.

Upper Down had lain several years on the Green-side : but was so poor, that some acres of it had but little sward on them ; and that was briery ; and of a poor hairy grass.

Some part of it, which was so poor, was plowed but once with a swing-plough ; and dragged and harrowed several times long-ways, as it was plowed, till there was earth enough raised, by that means, for sowing the seed : which was first sown with Buck-wheat, about two bushels in an acre, to shade the burnet ; and harrowed in long-ways several times ; afterwards rolled, and sown in with burnet-seed, about eight pounds to an acre : which was then well harrowed in long-ways, and rolled.

The other part of Upper Down was plowed, dragged, and harrowed, in the same manner ; then sown with summer vetches, or tares, harrowed, and rolled ; and afterwards sown with burnet seed, about sixteen pounds to an acre, well harrowed in, and rolled.

The Burnet sown with the buck-wheat in the Upper Down grew very well ; looked very green ; and, after the buck-wheat was mow-

ed, spread, and stood the winter very well : but it was sown too thin. On the other part of Upper Down, which was sown with the summer-vetches, the burnet throve very well ; and, after the summer-vetch was mowed, which in some part of the field got to be too strong and over-shadowed it, grew, and flourished very well. It was fed the next spring with sheep, till the latter end of May ; when it was laid up : and it was mowed for seed, the latter end of June. It produced twenty-four bushels per acre of seed saved : and as the season was bad, for saving it, 'tis believed more seed fell out, than the quantity actually saved. It was fed some time afterwards, before it was laid up for a spring-feed.

Upper Down, after being laid up for a spring-feed, was not fed till Candlemas-day : when there was a good head of grass in it. It was stocked with ninety couples of ewes, and lambs : which fed on it with a true relish : and it was of great service to them. As there was then no other grass for them but burnet ; and they fed strongly on it, so late as to the middle of May last. It was then laid up ; though it was but short ; and bore a middling quantity of seed : part of which fell out, on the account of the wetness of the season. The remainder of it was mowed ; and the seed saved ; the quantity of which we cannot ascertain.

certain. As the casualty of the season obliged us to put it with other burnet-seed; which grew in different fields, from either of the two above-mentioned.

Upper Down had a good head of after-grass; hath been fed with sheep; and is now laid up with a good head of burnet; promising well for the spring-feed.

Goldimore was partly spaded, and burnt, though imperfectly, from the wetness of the season. It was plowed, dragged, harrowed, rolled, and then sown with burnet, about eighteen pounds to the acre, harrowed in well, and rolled.

The burnet sown in Goldimore was fed in the spring; and laid up for mowing: but, the season being wet, there was not much of the seed saved. It fell out: but otherwise, the herb was well-seeded.

Goldimore had a good, and strong feed of burnet-grass in it; and was much thicker, by the seed's falling out. It was of great service; and fed during the last winter, and spring, by a stock of old ewes; which fed it close to the ground, when the snow covered it. It was hard-fed till the middle of May last; and then laid up. It grew very fast; flourishing; and bore a good quantity of seed: but the weather proving very wet and unseasonable at the proper time, when it should have been gathered in, and secured, the greatest

est part of it fell out. Some of it was mowed, and made into a rick, with what seed was left in it: which is not yet threshed out. The sheep feed on it very well; eat it very bare; and proved very well: and it was of great service to them, as there was no other grass but burnet, at that time, to feed on. It is now laid up with a good head of burnet-grass, for the spring-feeding.

We being three of the principal inhabitants of the parish of Whetstone, Devon, do certify, that the above account of the quantity of land; the quality of soil; the culture; the burnet-seed sown, and the produce of it; the feeding off the burnet with sheep; and its effects on the sheep; are true, according to the best of our belief and judgment; as witness our hands this 22d of November, 1768.

JOHN WILLS,

WILLIAM HORWELL,

WILLIAM HOLMAN.

ARTICLE

AGRICULTURE.

91

ARTICLE VIII

Observations on COLE-SEED; in which its Difference from Rape; and its Utility, with the various Methods of its Culture, as a Winter, and Spring-food for Neat Cattle, and Sheep; are explained.

THE Society for the Encouragement of Arts, Manufactures, and Commerce, last year made the culture of cole-seed, with a view to feeding neat-cattle and sheep in the winter and spring, an object of their premiums: and they have done the same this year in more than one light. Indeed, the greatly experienced advantage of this plant, for that purpose, had before established the cultivation of it in several counties of England: where its hardiness, copious product, and peculiar efficacy in fattening sheep are now extending its use. These circumstances have, at present, excited the public attention to the culture of this herb; which, notwithstanding its introduction into particular parts of the country, was till very lately scarcely known by name in most others; and occasioned many of those, who pursue improvements in agriculture, to make enquiries into its nature, and uses.

In order, therefore, to promote the views of the Society in their premiums for the improvement

ment of the culture of cole-seed, and the introducing it into more general practice; and to give some assistance to those, who are desirous of making experiments on this plant, to determine the best methods of management of it, and its utility compared with other similar kinds, for the purposes of feeding cattle, and sheep; I thought it might be expedient to furnish some account of its difference from rape, with which it is in general confounded; and of the most approved methods already practised in its cultivation for the uses here mentioned.

This is the more necessary, because the confounding the cole-seed, with the rape; which is cultivated for its oil only; and is not equally well adapted to the purposes of feeding cattle; has prevailed so much, that numbers, who have enquired for the seed of the first, have been misled, even by seeds-men, as well as others, to believe, that they are the same plant under different names: and consequently, that the Society have been led, through ignorance, or some blunder, into a mistake with respect to this point: which is, nevertheless, by no means the case. It is not, however, to be wondered at, that the London seeds-men, who seldom examine nicely into matters which do not concern staple articles of their trade; and who, dealing only in the retail shop-way, have little business with those seeds that are sown only in particular places of the country, where they

they may, consequently, be more conveniently had than through their hands; should fall into this error: nor, that others who gain their information from reading should be led into the same deception; as several circumstances have contributed to give foundation to it. The notion, that cole-feed, and rape, were the same plants, was easily adopted from their affinity of species, and the application of the seed of both, to the same purpose of making oil: as the cultivation of cole-feed for the feeding cattle, spreading itself into a great number of places, where that of rape, which is raised for the oil only, was never known, it might be easily imagined, they were the same. The confusion of writers, which has long obtained with respect to the true distinction of these plants; and which Tournefort complains of; and the adoption of the mistake of their being the same plant by most of the latest writers, who have treated of them, as an article of husbandry; have confirmed this error. Mr. Paulet, who had the conduct of the Museum Rusticum till the last eight months of its duration, said, in a note, "That cole-feed, and rape, were the same:" and the accounts of the cole-feed, given by correspondents in that work, agree with him in this assertion. Miller, in his Gardener's Dictionary, has also confounded the rape and cole-feed: as being names of the same plant. It is not to be wondered at, therefore,

therefore, that others, who do not live in places where both these plants are cultivated for their oil, or who are not particularly concerned in the sale or preparation of rape-oil, under which name both kinds generally pass; should be led to believe, rape and cole-seed are the same plants.

Mr. Varley, however, who has written upon husbandry has mentioned very justly, that rape and cole-seed are different plants; and has touched, in a general way, on the true distinction betwixt them. I endeavoured, myself, also, to set the matter in a clear light, in some notes on two letters from Mr. Wynne Baker, and another gentleman in Ireland, inserted in the *Museum Rusticum*, vol. VI. page 296, & seq. But this can only have rectified this notion with those, who have read these works.

It may consequently be a matter of utility at present, to point out the real difference betwixt the cole-seed, and rape; as well as to furnish to the public a distinct account of the best methods hitherto practised in the cultivation and use of cole-seed, for the purpose of feeding cattle and sheep.

The kind of plant, which was first sown in our country, as early as the time of queen Elizabeth, for obtaining the oil known then, and to the present, under the name of rape-oil, is a species of wild turnep, distinguished, by the earlier writers, by the names of *Bu-*

nias; *Bunias sylvestris*; *Napus sylvestris*; *Napus flore luteo*; and in English, *Navew gentle*, or *Wild navew*. The former writers on botany divided the turnep kind into two tribes: the *napus* and the *rapa*: but this species properly belongs to the first; and is so ranked by most authors: though, from the inaccuracy and confusion of names, in the earlier times, the oil was called rape-oil. And the plant itself has been since called so, by the common cultivators of it for that use.

This species, like the others of the *brassica* genus, which, in modern botany, includes both the cabbages and turneps, is apt to vary, or sport as the gardeners call it, with respect to the figure of the leaves; especially if any of the cabbage tribe grow near, or with it. These leaves are sometimes like those of the garden-turnep, and even more cut and jagged; and sometimes more entire; varying to those of the coleworts. Whence arises a difficulty of describing this plant, specifically; and that variation, in the authors who have attempted it. In other respects, this kind, resembles the common turnep: except that the root, which is much of the figure of a top, is not near so large. This species is tenderer than some others, both of the turnep and cabbage kind; and is sometimes destroyed in very severe winters: but it will bear the rigour of common seasons without suffering. The

The *cole-seed* has more affinity than the rape, with the cabbage kind; and is justly deemed of that tribe: being, in fact, a wild colewort. It is called by the older writers, *Brassica arvensis*;—*Brassica rubra minor*;—*Brassica sylvestris*;—*Crambe*;—*Colsa*: and in English *Field-colewort*. This plant resembles the other kinds of coleworts; but it is sometimes less; and frequently degenerates towards the turnep, in the appearance of its leaves. It may, however, be easily distinguished from the rape, or wild navew, by the leaves being less cut and jagged, and of a darker, and purplish colour; and by the root's not verging to a bulbous form; as is found in that, and all the turnep-tribe. It appears, by Lemery, to have been much cultivated in Flanders, in his time, for the sake of the oil obtained from the seed, under the name of *Colsa*. He says, "That the seed commonly
 " called *Navette* is not *Navew* seed, as many
 " imagine; but the seed of a kind of cole-
 " wort: which in Flanders is called *Colsa*;
 " and cultivated as well there, as in Nor-
 " mandy, Brie, and Holland." Gerard mentions, also, "that the *Bunias* or navew
 " gentle, and the *crambe* or field colewort
 " were both cultivated in foreign parts for
 " their oil, in his time: and that he had
 " heard, the navew gentle was cultivated for
 " the same purpose in England." It was
 much later, that the cole-seed was brought
 into

into use in England. It being only within the memory of persons now living, that this plant was procured from Flanders; and cultivated by those who were largely concerned in producing rape-seed for the making oil.— They imitated the practice followed in Flanders, of raising every year a proportion of it, as well as of the rape, on account of its superior hardiness: which secured them a crop of seed, when, from the extraordinary rigour of the winters, the rape might fail. The name of *Colsa* was brought hither with this plant from Flanders; and has been corrupted into that of cole-seed, by the rustic cultivators. It is not only hardier than the common rape; but produces a much greater burthen of herbage: and, on those two accounts, it has for some years been cultivated for feeding cattle, where there is no intention of reaping the seed. But it is still raised in other places for the seed only: and in some for both intentions together: as we shall see below.

The marquis de Turbilli, in his account of the culture of cole-seed, in Flanders, says, There are three kinds: The *white*; the *warm*; and the *cold*. He observes, that, “The *white* cole-seed is so called, from its
“having a white flower; and was introduced into Flanders from Holland, three or
“four years ago. They say, it resists the
“frost better than the next kind; yields somewhat more seed; and is generally ripe about
“ten

“ ten or fifteen days later.—The *warm* cole-
“ seed is most common in Flanders ; and es-
“ teemed the best : because it thrives in eve-
“ ry soil ; and requires less manure.—The
“ *cold* cole-seed seems to have been brought
“ from Holland, as well as the white. It
“ is, without doubt, the hardiest : resisting
“ the frosts best. It grows to a greater height
“ and size than the other : sometimes at-
“ taining nine or ten feet. Its seed is,
“ also larger : but the difference is scarcely
“ perceivable in this point. It is more sub-
“ ject to be damaged by insects than the
“ others ; and does not, like them, send
“ forth branches from the bottom of the
“ stalk. It, also, requires great plenty of
“ manure. The two last-mentioned sorts
“ have a yellow flower.” The reason of the
name of the white cole-seed, as given by the
Marquis de Turbilli, is very obvious. But
it does not appear, why the others are called
the *warm*, and the *cold*. It is the last, or cold
cole-seed, we cultivate here : the others not
having been brought into England : or, at
most, only as curiosities. The *warm* cole-
seed, however, as it thrives on poorer and
drier soils, and requires less manure, would,
undoubtedly be useful in some cases.

There are two methods now in practice,
for the cultivation of cole-seed ; whether for
the feeding cattle and sheep only ; or for that
purpose, and reaping the seed also. These
8 methods

methods are, the sowing the seed at large in the field, and hoeing it, as is done in the case of turneps; or the raising seedling plants in beds; and transplanting them into the field. The particulars of both these methods will be given below: but it is proper first to touch on those circumstances, which are general, and common to each method.

The kind of cole-seed, we cultivate, requires the best land, not only as to richness but texture of the soil. For a perfect pulverisation, or tilth, is necessary, as well as fertility of the land, to the obtaining great crops. It is in vain to expect them of this plant, either for seed, or pasturage, on a poor, dry, and cold soil. It thrives well on land subject naturally to be moist: provided it be rendered free from much wet, by draining, and a proper method of plowing: that is, by forming high ridges and deep furrows, venting themselves duly into drains. As the greatest richness of soil is thus necessary in the general method of culture of this plant, plenty of manure is in most cases requisite; or, at least expedient: especially where crops of the seed are desired. It may, however, sometimes be cultivated to advantage, with a moderate quantity of manure, on lands that would otherwise be destined to lea, or turnep-fallow, where a crop of spring-corn is to succeed it. In this case, being fed off early in the spring, the remaining stalk and

herbage may be plowed in, by a good drench-plough; and very good crops of barley are to be obtained by this means. The Marquis de Turbilli says, "He has seen cole-feed yield good crops on dry chalk soils, on which street-dirt had been laid." But this, according to other parts of his account, must be only understood of the warm kind; and not of that which we have.

As a good tilth is peculiarly requisite for great crops of cole-feed, where the land is newly broken up, and is of a stiff texture, four plowings are bestowed: but, in loose soils, three are sufficient. In stony land, it is proper, also, previously to the sowing, to break the land by harrowing or rolling, as occasion may indicate to be necessary. The ground in the plowing, should be laid in what is called four-bout lands; and where it is apt to be wet in winter, the ridges should be high; and the furrows deep, venting themselves into proper drains, that the plants may not lie under water in case of great rains.

The sowing in the field at large, in the broad-cast way, is the most general method practised in England, for the cultivating cole-feed for the feeding cattle and sheep. — In this case, if the land be ready, the seed should be sown in July. This may be always done where there is not a preceding crop of grain, or pulse, the same year. But as this plant may be cultivated with advantage, in many cases

cases where crops of grain or pulse have been reaped, it may be sown a month later: which will give time for the two plowings; and the laying on such a manure as may be necessary.

Various manures have been recommended, as most suitable to cole-seed, in different places. But it does not appear, that the particular advantage of any manure arises from its peculiar relation to this plant; but to its being best adapted to the melioration of the particular land, on which it happens to be cultivated. It is the fitness in this view, and the due quantity, on which the good effect of the manures depends. Pigeons dung, wood-ashes, street-dirt, and other kinds, have, however, their full efficacy, as strong manures, in the culture of this plant; and the beneficial choice of the rest must be decided on the experience previously had; or on a just speculative judgment of the nature of the soil.

In the preparation of the land to receive the seed of this plant, it is harrowed by some; and, by others, turned up in narrow spits, and shallow furrows. If the last method be pursued, a four or five-coultered plow, constructed properly for making seed-furrows with small intervals, may be used. There is a model of such a plow formed on very good principles in the collection of the Society for the Encouragement of Arts, &c.

The quantity of seed for an acre, when sown in broad-cast, has, by general experience, been found to be half a peck. This is sown by the hand, as other seed. The ground prepared, in either of the above ways, should be afterwards bush-harrowed to cover the seed. Where, however, the seed is intended to be sown on the furrowed lands, it would be best to use a proper drill-plow: which would not only save the trouble of hand-sowing, and bush-harrowing, by performing those operations along with the making the furrows; but, also, spare half the seed; and cause the rest to be more effectually covered.

When the seedling plants have risen from the seed-leaf, it is practised, in some places, to hoe them as turneps: leaving six inches, or, according to some, a foot distance, betwixt each. Others never hoe them; but let the plants rise together, and struggle with each other. The latter method is practised, as we shall see below, in the fenny countries: and, also, in some parts of Flanders. The first is more general here, in other places except the fens. Perhaps both these methods are right in the parts where they are practised. In cases, where the ground is very rich, and manure copiously used, the plants having a luxuriant growth, rise high, and spread wide: in which case, the greatest crop is gained by giving them room. When, on the contrary, the ground is poorer; or little manure

nure used, as in the fens, where the ashes of the burnt swarth only are employed; the filling the surface of the ground with the plants is most conducive to the increase of the burthen.

It sometimes happens from accidents, and other causes not easily distinguished, that the plants of the cole-seed fail wholly, or in a considerable degree, to rise in parts of the ground on which they have been sown. It is proper, in such cases, to transplant, into these vacancies, some of the plants, from places where they appear thickest. If this be done, in the evening, or on cloudy days, they will seldom fail of taking root, and doing well, if a slight watering be bestowed on them, should the weather prove very dry.

The cole-seed is apt to suffer from a variety of different insects, or small animals; which infest it in different places, and in different periods, of its growth. The most general in our country are *snails*, called *slugs*; the *black fly*; the *black canker*; and the *green caterpillar*. Cole-seed is also sometimes subject to the *smut*, where it is raised in foggy places, and a great quantity of fresh dung has been laid on the land.

It has been found a very efficacious remedy for the mischief resulting from the *snails*, to sow, over the young plants, a mixture of flaked lime, and wood-ashes, in the proportion of about ten of the lime, to fifteen of the ashes, for each acre. This not only an-

swers the purpose of destroying the snails, and other noxious animals ; but promotes greatly, as a manure, the growth of the cole-seed.

The *black fly* is a very small insect: so little, indeed, that, being nearly of the colour of the land, it is scarcely perceivable, but by its effects ; and its motion, which is observable on the herbage, like the hopping of a flea. It attacks the leaves of the young plants immediately after their first sprouting: in which case, after it has made great ravage, the only relief is to sow the land over again. For when the first leaves are destroyed the plantling dies. In this case, the land should be raised with a light wooden harrow, in order that the seed may strike root the sooner ; and less time be lost. A heavy harrow destroys the furrows.

The most effectual remedies against the black fly, when taken in time, have been pointed out in Mr. Reynolds' letter, on the turnep-rooted cabbage, inserted in the first volume of these Memoirs, page 436.

The *black canker* attacks the cole-seed in a more advanced stage of its growth : that is, when about the size of a small cabbage-plant.

This *canker*, as it is called, is a small black worm, about a quarter of an inch long. Windy and rainy weather are the best natural cures for this evil. There is, however, an artificial means of mitigating it ; which is this : Let two men take a cart-rope, each holding one end ; and draw it twice or three

times over the plants. It will beat the canker-worms off the plants; and either kill, or at least throw them on the ground, whence they seldom rise again.

The *green caterpillar* is the last enemy, which attacks the cole-seed plants; and comes about the latter end of September. It is a green grub of about an inch long. This animal makes great havock while it exists: but the frosty mornings generally soon destroy it. The means of art, by which it may be resisted, is, to use the same expedient as for the black canker.

The *smut* in cole-seed, as well as in grain, is more easily prevented than remedied. It should be avoided, to lay on too much fresh dung in damp places; or to mix a proportion of quick lime with it: which will, in general hinder the smut from affecting the cole-seed.

With respect to the thinning the plants, by hoeing, it must be left to the judgment of the cultivator, as before intimated; who must be directed in it, by the fertility of the soil, and the luxuriance of the plants: and either omit it; or settle the due distances of the plants, where it is practised, on that principle. This is, however, to be understood, where feeding cattle or sheep only, is the object of the culture. But in all cases, where a crop of seed is desired, the plants must be thinned to the distance of eight inches or a foot from each

each other: though this may be deferred, till they have been eaten down in the spring.

The manner, and time of feeding off cole-seed must be left, also, in a great degree, to the discretion of the farmer, according to his occasions, and views. Particular caution is, however, necessary, in the case of neat cattle, that they should not eat too much of it at first: and that some dry fodder should be given to them, at times, with it. There is less danger with respect to sheep: and ewes that have sucking lambs, may be indulged with it, without the least danger.

After the time of feeding off the cole-seed, it is sometimes suffered, as above-mentioned, to stand for a crop of seed: in which case due regard should be had, as above, to the thinning the plants; the destroying rank weeds; and, where practicable, loosening and stirring the ground: which last operation will greatly improve the crop. It is, therefore, much the best, where the land is rich, and there is any view of a crop of seed, after the feeding off, to sow this plant in equidistant rows; and to thin them in the spring, by taking away so many of the rows, as will leave the plants at two feet, or somewhat less distance. In such case, they may have two or three horse-hoeings, as the plants make a progress: which will not only much increase the product of seed, but be of great benefit to the land itself.

Where

Where there is no crop of seed intended, the cole-seed plants, after feeding them off, should be plowed into the land, by a proper drench plow. There is one of this kind, of an excellent construction, invented by Mr. Duckett, in the possession of the Society for the Encouragement of Arts, &c. The time of plowing in the cole-seed must depend on that of the feeding it off, and the future use that is to be made of the land. The plants should be well buried when it is done : otherwise they are apt to sprout again.

These are the particulars of the most general way of cultivating cole-seed, for the feeding cattle and sheep, when the plants are raised in the field where they are intended to grow ; and where rich and highly-manured ground is in question. But in the fenny countries, a different method is pursued : which is performed in the following manner.

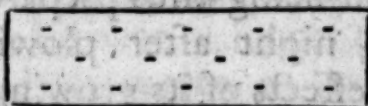
When the cole-seed is cultivated on the fen-lands, care must be taken, that it be in places, which will not be flooded for any length of time in winter. Wherever there is any descent, open drains may now be easily, and at a very small expence, made, by the drain-plow, procured by the premiums of the Society for the Encouragement of Arts : who have one kept in their possession as a model. It is in general on ground fresh broken up for that purpose this plant is sown in the fens : because, besides the benefit of
the

the cole-feed crop, there is an advantage in the preparation of the land for other crops. Ground which has not been broken up for four or five years, though before in tillage, becomes again fit for this culture.

The treatment of the fresh land for the receiving the cole-feed, is by plowing and burning the sward: which latter operation stands in the place of manure; as the ashes are afterwards plowed into the soil.

The plowing, previous to the burning, is performed about the middle of May, and where practicable, it should be from east to west, that the plowing for the seed may be from north to south: the plow usually employed is of that kind, commonly called the Dutch plow. The share of it is large, with thin edges and a sharp point: which are kept in order by filing. The fods raised by the plowing are to be about seven, or eight inches wide; and thin; that is to say, not above an inch and half in thickness. Baulks or missings should be spared as much as is possible. When the turf has been raised, it should be suffered to lye till it be dry; and then be collected into heaps. The magnitude of these heaps should be that of middling grass-cocks: and they should be made of a tapering form, that the wet may run off. It is usual to put one person to every seven furrows in the work of forming the heaps: by which means the whole will be regularly carried on. The
heaps

heaps should not be placed equidistantly in the rows : but in the quincunx manner : that is, the heaps in one row are to be placed opposite to the middle of each interval of the other ; as that admits of the ashes being more easily and equally spread. It may be best understood by those, who are not acquainted with the term quincunx, by this figure.



After the turf is dry, and the heaps formed, they should be burnt as soon as possible, to avoid their being again soaked, if continued rain should happen ; and to prevent the ground from being covered with grass, and herbs : which will soon sprout in case of wet ; and, in a great degree, defeat the end of the first plowing. As the ground will then, forming a new sward, cohere again ; and resist being broken by the second plowing : in consequence of which the seed, when sown, would be buried only in the depth of the furrows ; and not be diffused elsewhere.

When the heaps are burnt, the ashes must be spread as equally as possible over the land : and the second plowing should then be performed as quickly as possible : following the other operations as fast as sufficient parts of the land are prepared for it. This plowing should be cross-wise to the first. The distance of the furrows should be the same as
in

in the first plowing: and they should be about two inches deep. For the soil being tough, rather than disposed to break, there will be more seams by this management than if the distances were greater. The lands are formed of the width of about ten paces, that the furrows betwixt them may carry off the water, where there is a descent.

The ground being thus prepared, it is usually sown the night after plowing: which prevents the effects of its growing too dry.

The quantity of seed is, as before-mentioned, half a peck: which is spread as equally as possible by the hand.

The ground is to be then bush-harrowed, as soon as possible after the sowing, to cover the seed. This is performed by a hurdle charged with branches of the haw-thorn.

The hoeing, or thinning, when the plants are come up, is omitted in the fen culture of the cole-feed: and, indeed, considering the rough state in which the land is, according to the mode of tillage here described, it would scarcely be practicable. Moreover, the want of greater richness in the soil from the defect of manure, which is here only the ashes of the turf, prevents, as above-mentioned, such a luxuriant growth as would demand thinning.

The cole-feed, is therefore, suffered to remain without any operation till Michaelmas: at which time, it is usual to begin to feed it off. This is most generally done by putting in sheep,

sheep, in order to complete the fattening them for the market; which purpose is much sooner and more effectually answered by cole-seed, than by turneps, or almost any other kind of pasturage known. Indeed, it is observed, they will grow fatter in one month with cole-seed, than in two with turneps. The sheep to be so fed are, for the most part, such as are already half or three parts fat. If they be poor, a longer time is required. There is, however, no positive reason to consume the cole-seed so early. Where there is a prospect of wanting it later, the feeding off may be deferred to any part of the winter, according to the farmer's convenience.

The cole-seed, in this culture, is mostly reserved, after it has answered the end of pasturage, for a crop of seed the succeeding summer; and sometimes not. This depends on the goodness of the soil, and other accidents, which may render the produce promising, or otherwise. But where the herbage appears strong, it is generally found advantageous. When it is decided, to let the cole-seed stand for a crop of seed, the eating off should be finished before or about Candlemas: that the spring-shoots for the flower-stalks may not be injured. But, if no crop of seed be intended, the consumption of the herbage, or the feeding off, may be deferred later in the spring, according to the occasion, or prospect of want, of the farmer.

It

It is a good practice, where a crop of seed is proposed to mow the stumps of the plants grazed by the sheep, or by the cattle, within three or four inches of the ground : otherwise being left jagged, and torn, they receive the moisture when rain falls ; and occasion the plants to rot and die : or, if they escape, they dwindle, and are inferior in vigour to those which are mowed.

The cole-seed is then suffered to rise in this condition ; and is left to itself to flower ; and produce its seed. But, when the seed-pod is formed, it is frequently attacked by an enemy, that makes such ravage, as sometimes to render the crop scarcely worth reaping.

This is a small *green fly*, which besets the tender pods ; and destroys them. As this animal possesses itself of the uppermost part of the plant, which is now high, it is too much raised above the ground, to admit of any of the means being effectually used to destroy it, which have been before mentioned to avail against the enemies of the young plants. The only practicable way to mitigate this mischief is, by smoking the field : which, when performed with due advantages of wind, and a light atmosphere, will sometimes produce a considerable destruction, or expulsion of the flies.

The next attention is, to observe carefully when the cole-seed is of due ripeness to be reaped. It is very material to watch the proper

proper maturity : which is, before the pods dry, and turn brown. For, if it be suffered to go on to full ripeness, this seed is so apt to shed on the least motion, that a great loss of it will, of course, happen in the reaping. It is proper, for this reason, to begin to cut the cole-seed, as soon as any of the pods appear brownish : which is the best criterion, or mark, for distinguishing the time. This must be done, even though most of the pods appear backward in ripeness : for the succulence of the stalk will feed the seed during the drying ; and bring it to nearly as good a state, as that, which seemed most forward at the time of cutting.

The cole-seed being, according to these appearances, in a proper state for being reaped, this work must be performed as quickly as possible. The method of reaping is the same with that for corn, except the following particular. The reaps are to be laid on the ground in a different manner from those of other crops. The seeded heads of the plant are not to be all turned the same way : nor lye, consequently, in each row at the opposite end of the stalk of the other. But those of every two rows are to lye together ; that is, two reapers are to work opposite to each other ; and each is to turn the head of what he reaps towards the other ; so that the heads of the reaps will be towards each other : but

they should not, nevertheless, be brought so near as to touch.

When the reaping is thus performed, the cole-seed must lye on the ground, in this condition, till it be of proper dryness for threshing. It will not bear turning, like other plants; because the pods of the upper part, being dry, would open; and shed the seed so as to make a very great loss.—The time of drying cannot be reduced to any particular period: as it depends on the accidents of the weather. It must, therefore, be left to discretion. The means of judging rightly of it, is by the appearance of the reaped plant. When the stalk, or straw, seems dead, and is become white; and the seeds, on opening the pod, or as it is called the *cosh*, are black and plump, separating easily, or being nearly loose from the *cosh*; it may be concluded, the cole-seed is in a fit state for threshing. If, however, the under-part appear greenish, when the upper-part is fully fit for threshing, the whole must be gently raised from the ground; and made to rest, or bear on the stubs, so that the air may pass under it. This raising is generally performed the morning of the day on which the cole-seed is to be threshed: as it will be sufficiently dry before, what is called the bolster, is completely made; and the people employed have breakfasted.

The

The threshing is done in the field upon a cloth; which is about twenty yards long, and eighteen yards wide. The cloth and the operation, are called a *cole-seed sale*: and it is somewhat difficult to give a *clear* notion of the different offices of the persons employed, and the manner in which they go through them.

The number of people engaged in this work are about twenty. Of these, about seven are *gatherers*, who are women, and great boys or girls. This is the number where there is a midling crop: but where it is thin, more are required to supply the threshers with constant work; and, where thick, less. These people bring the reaps together with a sickle: for if they did not employ that instrument, they would squeeze them together too much; and, consequently, force a material part of the seed out of the pods or coss. They then put what they have collected into a sheet, called the *bearing sheet*; of which there are two used in every sale. This sheet is about seven feet wide; and has hoops on each side, through which a light pole is put. When it is filled with the reaps, it is borne by two strong men, called, on this occasion, *bearers*, to the threshing-cloth; and there deposited.

Instead of performing this work by hand, some have no bearers; but employ a carriage, which is called a *cole-seed cart*, to convey the

reaps to the threshing-sheet. This cart is made as wide and long as is practicable; has a sheet laid in it; and is drawn by one horse. The cole-seed is put into it with the greatest care and gentleness, till as much be laid in it as it will bear. This is the general practice in some parts of Flanders, and followed by a few here. But the employing bearers is far preferable: as the other method requires almost as much help to load and unload, besides the use of a horse, and a boy to drive it: and the reaps cannot be put in and taken out of the cart without shaking out a material part of the seed.

When the reaps are thus laid on the cloth, a man, called the *layer on*, places them, in a row, across it. They are then threshed by four *threshers*: who stand two on each side one row or floor of the reaps. While the *threshers* are performing their office on the first row, the *layer on* prepares another row at a proper distance from it: and a woman, with a rake, follows the threshers; and turns the reaps. The threshers then proceed to the second row, followed in the same manner: and, having gone through it, turn again to the first; and repeat the threshing: proceeding in the same manner with the second row. They have then finished their work, as to the first quantity: and they continue to go on so in succession with the rest. But there are two men, called *shakers off*, who come immediately

immediately after them. The first of these throws the cole-seed up with a wooden fork; and the other strikes it with an instrument of the same kind, as it rises. This knocks the remainder of the seed out of the pods, or cosh; and frees it from the straw: which, with the same forks, the two men convey from the cloth, over the bolster to another man called, in this office, the *Jack Straw*; who takes it quite away. There are, also, two other persons, one a woman, the other a man, who follow the shakers-off. These are called the *before caver* and the *behind caver*. Their business is to take off the emptied coshes; and the short broken pieces of straw, with rakes made for that purpose. The behind caver, who is a man, has very hard work, if he perform it with due care and activity: and on his dexterity and diligence, depends the saving a considerable part of the seed.

By this set of people, thus employed, in the case of a good crop, thirty combs, or one hundred and twenty Winchester bushels, may be threshed in a day. But, in the case of a bad crop, only ten or twelve combs.

The cole-seed, being thus threshed, is left on the cloth, till the next morning: when the threshers, with other help, go early, and cast it on the cloth, to cleanse it: after which it is immediately put into sacks: and carried off in a waggon: so that the cloth is cleared, and

ready, against the others of the people come to work, if there be more to be done.

The produce of an acre of cole-seed, in a middling crop raised by this method of culture, is about seven combs or twenty-eight bushels. The value of it at market is very uncertain: as such value depends, on the season, and other contingent circumstances. Considering, however, that this method of managing the cole-seed is not expensive in the work; — the seed sown a matter of trifling expence; being only half a peck for an acre; which makes the yield two hundred and twenty-four fold; — and the cost of manure spared; as none is used but the burnt ashes of the turf; — the cultivation of this plant must, of course, be attended with a considerable profit in this mode of it. For when the crop of seed succeeds, the double source of gain, from that and the pasturage, must render the whole great: and, when the crop of seed fails, the pasturage will more than indemnify the cultivator for the rent, seed sown, and burning and plowing; which then make the whole expence: that of reaping being saved when the crop of seed is given up.

The foregoing are the methods pursued, where the plant is sown at large in the field, where it is designed to grow. The other method of transplantation was formerly the only one pursued in England, in the culture of

of rape, for the oil: and is now practised, also, in some parts of Flanders in the culture of cole-seed. Possibly in very rich land, and where great quantities of manure can be bestowed, this method, as it produces very great crops of the seed, is most profitable. But the other, where a dependance is principally had on the feeding cattle or sheep, is more accommodated to general cases. Where, however, it may appear beneficial to cultivate cole-seed after crops of grain, which cannot be got off the land sufficiently early to admit of sowing cole-seed on it the same season,—the method of transplantation must, of course, be used. For which reason, as it may be an object worthy regard to raise cole-seed in this manner on very good land, where the procuring a quantity of green winter-food is casually of great consequence, and no adequate provision has been made for it in the spring, I will here give the particulars of the method, which long and extensive practice in Flanders has rendered most approveable.

A fifth part of the land, on which the cole-seed is to be cultivated, must be prepared in the autumn and spring, preceding the time of sowing. The other four parts may be employed for any crop, the same year the cole-seed is to be planted on it. The first fifth part is to be employed for raising the plantlings for the other four: and the tillage for the cole-seed may be begun as soon as

any preceding crop has been cleared off. The land should have two plowings before winter, at some distance of time from each other; and the one should, where practicable, be crosswise to the other. In the month of May, another deep plowing should be given: after which the land should be harrowed two or three times, and then rolled, in order to bring it to a good state of pulverisation.

Towards the 18th or 20th of July, the land should be again plowed; and, also, harrowed and rolled, till it be perfectly fine. The seed should then be sown, in the proportion of eight pounds to an acre: and this is generally performed by sprinkling it with the thumb and two fingers. The ground should then be lightly harrowed, and rolled, to cover the seed. It is then left in this state, till the seedling plants be ready for transplantation. The plants, raised thus on one acre, are sufficient for planting four others.

The land, on which these seedlings are to be transplanted, may bear any crop the same summer; provided it be removed by the middle, or, at farthest, the end of August. It should, as soon as it is at liberty, be plowed twice; and, ten or fifteen days afterwards, it should be twice harrowed. The manure, if any be now used, is to be laid on and mixed with the soil in these plowings. About the end of September, it should again have a deep plowing;

plowing; and it should then be formed into five-bout lands with deep furrows or trenches betwixt each. If there be any descent in the ground, these lands should be laid in an oblique direction, that the water may pass off the more easily.

The ground being thus prepared, in the beginning of October the most vigorous and promising plants should be taken from the seedling acre; and, being tied in bunches, carried to it; in order to their being planted out. They are to be disposed in rows across the furrows: the rows being one foot distance from each other; and the plants six inches distant in the rows.

The manner of performing the planting is thus: A number of men advance; and, in a parallel line, make two holes in the ground at the distance of six inches from each other, by striking a dibble, or fork, with two short prongs, into the ground; taking care to keep the instruments, when they strike, in a line with each other; and not to bring them nearer than a foot. Women or children, bearing the bunches of the plants, follow; and put the root of one into every hole: closing the ground to it afterwards with the heel of their shoe. By thus working, with both hands and feet, they make great dispatch.

When the transplantation is finished, if the land were not manured at the time of plowing, it is usual to sprinkle it over with pigeons

pigeons dung, dried so as to be powdered. This is found to have the quickest effect of any species of manure. The quantity of this powder is sixty bushels to an acre.

After this, the loose earth in the trenches, or deep furrows, is to be thrown by a shovel, or scooping-spade, amongst the plants in the rows. A spit of earth should be, likewise, again thrown, in the spring, out of the trenches into the intervals betwixt the rows of the plants. This tillage is of benefit to the crop in choaking the weeds; and keeping the surface of the ground in a state to imbibe the moisture.

The cole-feed will then grow a-pace, giving the lands the appearance of so many well-planted beds; and, if it thrive well, will fill up the spaces of the trenches; and make one intire thicket.

In the beginning of July, the seed is fit to gather; which is distinguished by the pods turning yellow. But, if one part of the field be ripe before the other, it must be reaped separately; and the gavels being left on the ground till the other part also be cut, they will take no harm. The first which is ready should be reaped like corn: and the reaps laid in pretty large gavels on the beds. If the seed be ripe, this should be done only in the morning, or evening: or a considerable part will shed and be lost.

After

After the gavels have lain thus three or four days, they are carried to a proper place in order to be stacked. This is done in cloths, to keep the seed from being lost : as a part of it will, of course, shed by the motion, when it is in a state of dryness. This stacking may be performed, even though there has been rain within three or four hours : provided the reaped cole-seed has before lain a due time to dry. The stacks are formed in one or more parts of the field, according to convenience, with regard to the extent of the ground, and quantity of the crop. The Flemish farmers never thatch these stacks ; but have the art of giving them such a sloping form, that the rain passes off without penetrating them so as to injure the cole-seed.

In these stacks, the herbage of the cole-seed ferments and heats : which ripens the seed ; and makes it yield a greater quantity of the oil : but in the unripe state it was reaped, it would, otherwise, be very defective without that operation. Where it is not to be stacked, it is, therefore, left to dry longer : but without great care, much of the seed will be then lost in gathering the reaps together to thresh them.

In this particular of management, there is a very material difference betwixt the practice, before described, of our fen-farmers ; and the Flemish cultivators of cole-seed : and it would be a point worth regard to determine, what

what the different proportion of oil would be in the seed of cole-feed, that had been stacked, and that which had been threshed as soon as sufficiently dry, without stacking.

The cole-feed, when stacked, is suffered to remain in that state till the month of September: when a kind of flooring being made in the field, it is there threshed; and the seed cleansed.

The seed is cleansed by means of parchment sieves. If there be any current of wind at the time, advantage is taken of it for winnowing: but, if not, wind-fans are used; as for grain.

The seed is then carried to the granary; and, being frequently stirred, is kept there till it be sent to the mills, or the market.

That seed which exceeds most in driness and weight, is judged the best: but it is usual, also, to break some of the grains on a table; and observe how they appear to abound in oil: for, by this criterion, the dealers, who have experience, can judge accurately of the value.

The crop remaining in the acre, on which the seedlings were raised for transplantation, is not suffered to grow for seed, but eaten off by cattle; except where the land is manured for another crop. But this depends on convenience of circumstances. For more than a sufficient number of plants being left after the others are drawn, they may be easily reduced
at

at any time, by hoeing, to the same state with those on the four acres of the transplantation.

It is practised, in some places, to make furrows at the due distance, by means of a proper plow; to lay the plants correspondently in these furrows; and then to cover them, by throwing in the earth. But this method is far inferior to that of planting by the two-pronged dibble: unless where it becomes necessary from any delay of the transplantation, which may render the roots too long to admit of having holes made for them, by the dibble, of sufficient depth.

The above are the material particulars of the method practised in most parts of Flanders, where the cole-seed is raised for the sake of its oil. But there are other places where the cole-seed is sown at large in the field, where it is intended to ripen.

In Flanders, the cakes of the seed are used for feeding neat cattle and sheep, in the manner of the linseed-cakes here. But with us, they are only employed as manure: the cattle being found to refuse them. It appears, that this is owing to a want of the knowledge of the expedient made use of in Flanders, for rendering them palatable to these beasts. This is the powdering them; and mixing them with bran: in which state the cattle do not reject them. It is observed, that the cows fed with them give very copious meals of milk.

The

The pods or cavings of the seed, as well as the little tufts of leaves on the plant, are readily eaten by both cattle and sheep. And they are laid up carefully from wet, to be kept as a winter-fodder. The stalks are, also, used in Flanders for heating ovens; making beds for barns; and sometimes for manure. But they require considerable time to rot.

The crop of seed on an acre in Flanders is computed, one year with another, at eight pounds ten shillings sterling value. It is, at present of much higher price here. In places, where there are no mills near for pressing the oil, there may be some difficulty in disposing of the seed. But this cannot hold good of any situations, whence it can be conveyed, at a moderate expence of carriage, to London: as a market will always be immediately found for it there. Cole-feed should not be cultivated more than once in four or five years on the same land: but it may be raised on land newly broken up; or such as has had other crops the preceding four years. In fen-land, according to the method prescribed, the expence being small, and consisting almost wholly in labour, it affords good profit from its advantages in feeding sheep. In a very rich land, or where there is great plenty of manure, the other method of transplantation affords a great return in the oil: and the land will be in good condition, and tilth, for any other crop, when this is reaped. On the whole,

whole, it appears, that this plant may be cultivated in a great number of places, where it is now neglected, to the benefit both of the farmer, and the public.

I have, therefore, given the various methods, by which cole-seed is cultivated both in our own country, and abroad. And I have not confined my account only to what is practised with a view to the feeding of neat cattle and sheep, or that intention jointly with the obtaining the seed for oil; but taken in, also, what respects the culture, where the production of the seed for oil is the principal concern: as there is a great connexion betwixt the two views: and what is done in one serves much to illustrate the reasons of proceeding in the other. I have, likewise, endeavoured to point out the principles on which the variation of these methods are founded; and on which, each may be deemed in some particulars defective, where they are too generally adhered to.

From this survey of the several modes of practice, and the circumstances under which each has been instituted, important lights may be gained, by those who pursue any of them from local usage, for introducing improvements from the hints furnished by the other. Original cultivators, also, will be thence enabled to form a judgment from the whole, whether the adopting any of these methods simply, or combining certain particulars, of

any of them, to form a new mode of practice, may best suit the circumstances of their undertakings, with respect to soil; intention solely of feeding cattle and sheep; or of that and reaping the seed concurrently; under which they enter on the culture of this plant in large, or to make experimental trials. Without such collective information, the efforts of the Society, to produce a more general cultivation of any plant, at present, known only to particulars, can have but a slow and languid operation: as the people, who are ignorant of the advantages of any such plant, are also ignorant of the way to gain them; and destitute, for the most part, of the means of acquiring adequate knowledge of that way.

R. DOSSIE.

ARTICLE

ARTICLE IX.

Account of a Method of Brining Corn, to prevent Smut; with general Observations on the Nature and Causes of Smut; communicated by Mr. REYNOLDS to the Society for the Encouragement of Arts, Manufactures, and Commerce; and inserted at their Request.

To Robert Doffie, Esq.

SIR,

I Am directed by the Society for the Encouragement of Arts, Manufactures, and Commerce, to send you Mr. REYNOLDS' Letters on the Brining and Liming Wheat, and the Nature and Cure of Smut in Corn; in order to their being inserted in the Memoirs of Agriculture, &c. if you think proper.

By Order of the Society,

PETER TEMPLEMAN, Secretary.

To Dr. Templeman.

WORTHY SIR,

Adisham, Nov. 3, 1768.

FINDING what has been communicated by me, relating to husbandry and agriculture, &c. acceptable to the Honourable

VOL. II.

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Society

Society for the Encouragement of Arts, &c. and being willing to render myself as useful as I possibly can to the community, and withal to oblige those respectable gentlemen you have the honour to represent, I shall, by your means, lay before them a very useful method, that I have long practised, to prevent the smut in our wheat-crops. A thing of no small consequence to the public in general; but extremely prejudicial to the farmer; and which makes our bread both black and ill-tasted too.

The following recipe will assuredly prevent the smut; and render both the sowing, and the drilling of the wheat much more easy and certain, (I mean as to quantity of product) than any other method hitherto practised, that I ever heard of, by the following pickle.

A tub is to be procured, that has a hole at the bottom; in which a staff, and a tap-hose, are to be fixed over a wisp of straw, to prevent any small pieces of lime passing, (as in the brewing-way). This done, put in seventy gallons of water; and then a corn-bushel heaped full of stone-lime unslaked; stirring it well till the whole be dissolved, or mixed; and letting it stand about thirty hours. Afterwards run it off into another tub, as clear as may be, in the manner practised for beer. This generally produces about a hog-shead of good strong lime-water. To this add three pecks of salt: which will weigh forty-two pounds; and, with a little stirring, will soon

soon dissolve. Thus there is obtained a proper pickle for the purpose of brining, and liming the seed-wheat, without any manner of obstacle. This is preferable to the common way; and greatly facilitates the drilling, where that method of culture is used.

In this liquor steep the wheat in a broad-bottomed basket of about twenty-four inches diameter, and twenty inches depth, made on purpose for large sowings: running in the grain gradually in small quantities, from ten or twelve gallons up to sixteen gallons; and stirring it. What floats must be skimmed off with a strainer; and must not be sown. Then draw up the basket, to drain over the pickle for a few minutes.—The whole of this operation may be performed within half an hour; and the seed will be duly pickled. After which proceed as before.—This done, the wheat will be fit for sowing in twenty-four hours *, if required. But if

* The Society, having thought proper to publish the above recipe in some of the news-papers, added the following *Nota Bene*: "Since the above communication, the Society have received information, that, on experiment, it has been found, the wheat may be sown in two hours after its being put into the brine; provided the brine be strong enough; and due attention has been paid to the strength of the lime-water." It was thought proper, by the Society, after they were apprized of this fact, to give an intimation of it to the public. Because instances, may happen, where a fair opportunity may offer to the farmer of sowing his wheat, which might probably be lost, if he were to wait a day or two, for the preparation

designed for drilling, it will be found best two days after the pickling. And if it be prepared four or five days before-hand, in either case it makes no difference at all, that I know of. But, in the case of drilling, should the seed be clammy, and stick to the notches in the drill-box, more lime must be added to the *lime-water*. Here the master must use his direction, as the case requires. For some lime has much more drying and astringent qualities in it than other.—If sea-water can be obtained conveniently, less salt will suffice. But some will be found necessary even then: otherwise light grains will not float: a thing which is of more consequence than is generally imagined. These light grains ought, therefore, to be carefully skimmed off; and thrown aside for poultry, &c.

Gentlemen, I say this from well-grounded experience: having practised this method for thirty years past; and never had any black wheat, when the seed was prepared as above, either for sowing in broad-cast, or drilling*, in a great variety of soils; and on large quan-

preparation of his seed-corn by brining. The method is, therefore, rendered more generally useful, by shewing, that the restriction of not sowing under twenty-four hours may be dispensed with, where inconvenient. R. D.

* The use of this method of brining and liming the seed-corn, may be of great consequence in facilitating the practice of the drill-culture. The supposed necessity of employing lime in substance, has been frequently a great impediment to the success of drilling, by causing an ob-

struction

tities of land too. This is confirmation enough for me to continue its practice: and seeing thus its utility, I throw another mite into the Society's noble Treasury of Arts, &c. for the benefit of my countrymen; which, I trust, will be acceptable.

I am, my Lords and Gentlemen,

Your most dutiful, humble servant,

JOHN REYNOLDS.

To Dr. *Templeman*.

WORTHY SIR,

Adisham, Nov. 4, 1768.

FOR the better understanding of my letter written yesterday, I would add, by way of postscript, the under-written: which, perhaps, may render my communication more satisfactory, in some particulars, than it now is; and explain what may seem abstruse in the latter part, where I speak of the ill consequences relating to light grain, &c.

fruition to the discharge of the seed from the drill-boxes: and a very unequal distribution of it in the furrows: as appears from the facts mentioned by Sir Digby Legard, in article VI. ; and by others, who have given accounts of their experiments in drilling.

This difficulty is entirely removed by the means here proposed, for the preparing the wheat by a solution of the lime in the brine: which seems, at the same time, to answer effectually all the purposes of using lime in substance.
R. D.

POSTSCRIPT to the preceding LETTER.

THAT many of the deformed light grains especially, are often infected, or charged with smutty qualities, in case they grew where there was an appearance of smut near them, is, I am confident, very certain. And, no doubt, these very grains are capable, by the matter contained in them, of conveying this disorder to the sound. Thus a succession is kept up from one generation to another without end.—But, in what manner this smut is propagated; and how conveyed and increased; the learned are not yet agreed. Nor can I pretend to say any thing certain herein.

However, this is most probably effected by imperceptible insects, that, at certain seasons, lodge in the seed-vessels, *farina* like; and, bring on a state of corruption, we find, turn to a black stinking powder; fraught, perhaps, with numberless animalcules, &c.

PARENTS OF THIS DISEASE.

Happy it is, we have a remedy before us, that will effectually prevent its spreading.

To Dr. Templeman.

WORTHY SIR, Adisbham, Nov. 20, 1768.

ACCORDING to promise, you have here a more perfect account of such observations, and remarks, as I have made for many years past,

past, relating to the cause, and pernicious effects of smut, more distinctly set forth in all respects, I think, than has been heretofore done, by any one that I know of.

The particulars I am going to mention are selected from my memorandums, made from 1730 to 1739, of the result of a number of experiments, and trials of divers kinds, too numerous to be recited in this place. Wherefore, I shall now confine myself chiefly to point out the cause, and the bad consequences of this disease in corn.

There are two kinds of smut, both found to be very prejudicial to corn; but which affect it in different degrees.—The one I shall call *open* or *loose smut*: and the other, being the shelly incruusted kind, *bag smut*; which is the common name of it here. Both of them are but too well known to the land-holders; only with this difference; that the loose smut is thought insignificant, or much less injurious than the other.

My opinion is, however, quite the reverse. And I dare pronounce, that both those disorders proceed from a like cause: which is the infection of insects; or some kind of small animals, such as the learned call animalcules, generated in the plants; and from no other cause whatsoever. For we see the open loose smut either more or less affects the reed-tribe; and extends itself not only to wheat but also to rye, barley, and oats: and,

with respect to the two last, to a very high degree: insomuch, that it is common to see a twentieth part thus infected. And there does not even want instances of an eighth, or a sixth part, being thus *blighted*; as the farmers term it.

We may, therefore, see that this disorder is more prejudicial than the other species; because it is more universal. Nevertheless, the evil is in a great measure overlooked, or disregarded: notwithstanding it greatly lessens the product of the land, according as the grain happens to be more or less afflicted by the disease. But yet we hear few or no complaints concerning this malady; the reason of which I take to be this:—It has long been, and still continues a received opinion, that this kind of smut proceeds from a natural cause of decay, either in the root, or seed: and it is no further examined. The product, or substance being blown away, spent, and left in the fields, little or none comes into the barn to affect the grain with blackness, as the other does. Whence it is concluded to be (as I said before) quite insignificant: a mere nothing. However, this is certainly a great mistake.

In order to remove these prejudices, which are very injurious, I intreat, that it be considered, this powerful enemy never fails constantly to make its appearance in the fields, when the grain is coming into bloom; and is
seen

seen at no other season but when the corn is generating. This is a very remarkable circumstance, which I desire may be particularly observed; because accidents, and defects, &c. so often pleaded, can have no part at all in the cause: seeing it is thus regular in its course. We may, at this time, behold the habitations of these animals broken down, and shattered all to pieces; their provision gone; and the whole ear devoured; nothing being left but the black dusky particles, intermixed with the eggs and progeny of such insects, as brought on the cause.

From hence, the sound corn certainly becomes infected, by their *ova* or eggs falling in with the *farina*, at this juncture, while the corn is forming. This accounts for those deformed light grains, that we know are infected with smutty qualities: and it is easy to conceive, how this dusty progeny may be conveyed into the seed-vessels of the corn, by the air; and, in process of time, devour that matter, which would otherwise have produced the grain: of whatever species nature designed; whether wheat, rye, barley, or oats. This I take to be the case: and we have woful experience to confirm it.

The other incruusted enemy, or *bagg-smut* brood, act, indeed, more privately; and occasion the greatest disorders among the wheat, when it comes to maturity. Because its blackness renders it odious, and sometimes
totally

totally unfit for bread. These vermin stick in the outward coats; for wheat has two, during their abode in the barn; especially after threshing: when the baggs are broken; and the grain becomes mixed. Their existence, is, however, but of short duration. For, unless the grain be committed to the earth in due time, they certainly perish. Because, we find, from well-grounded experience, that old seed, sown in its natural state, is free from smut in the next generations: as numbers can witness. And we have recent instances to confirm this even in the last year's growth. For none of the foreign wheat, that was one, two, or three years old, sown in these parts, had any such disorders,

But, with new seed, the case is manifestly different. The enemy stands at the door of vegetation; passes along, when it is open, as the plant advances; unites afterwards with the floury substance designed for food; and, in the end, devours that matter, which would, otherwise, become flour in the grains; leaving, instead of it, a noxious black powder infected with the eggs, brood, and excrements of the insects: hences comes that offensive smell.—This accounts for the disease; and shews us pretty plainly, that it proceeds from insects, and vermin, &c. only. The explanation here given may seem mysterious to many. But to proceed, when the grain is put into a growing state, the organs soon become

come expanded divers ways, for the circulation of the juices, that form the root, stem, leaves, and ear, &c. necessary for bringing the fruit to perfection: and, from hence we may be led to conceive how, when the vegetation is begun, these minute creatures, which first but lodged without, may afterwards creep into these tubes, or vessels, during the time their own state requires, when the corn is growing; and how both themselves and the plant arrive at maturity, at one and the same period together.

This is very similar to other productions, that we are certain of. Such as are found in the pods of beans, peas, hemp, hops, flax, stone-fruits, nuts, &c.; and can any one assign a good reason, why they may not take place in wheat, rye, barley, and oats, likewise. Here I stand upon firm ground: for none can dispute this.

Finding insects the cause of smut, I invented the pickle above specified, to destroy their brood: and it has effectually answered the purpose ever since, for about thirty years past; and rendered the grain better, both for sowing and drilling: so that I flatter myself, to have found out as well the cause as cure of smut: things essential; and worth due observation. My dutiful respects attend the honourable Society: and I am,

Sir, your affectionate humble servant,

JOHN REYNOLDS.

ARTICLE X.

*Observations on Pine-trees, and Larches ;
respecting the Advantages of planting them,
and some useful Particulars in the Method of
it : communicated in a Letter to the Editor.*

To Robert Dossie, Esq.

S I R,

I Have perused your publication with pleasure: and have sent for your inspection, some observations, that I have made on pines, firs, and larches. If they contain any information, that may be of service to planters, you are at liberty to insert them in your Memoirs: otherwise, I desire you to commit them to the flames. According to your promise, I desire you will correct all inaccuracies of style, as I have only attended to facts.

Flumen amen, sylvasque inglorius.

OBSERVATIONS on Pines, Firs, and Larches.

IN raising these trees, care should be taken, that they are skreened from much sun: and it is necessary, the beds should be covered with nets, till the seed falls from the head of the young plant. They should be removed
once

once, or twice, before they are planted out to remain: at which time, they ought not to be above four foot high: and may be put from four to six asunder. At six foot there will go twelve hundred and ten to plant an acre. They should be thinned gradually: and, in twenty years, only such numbers should remain, as may be left for timber. I believe, they do not require a greater distance, than four yards; so that two hundred and forty may remain on an acre. That they do not require more room (especially the Scotch fir.) I infer, from the fir's being a tree, which does not extend its branches to a great distance;—and from having seen them thrive well at that distance: the reason of which I imagine to be this. Hales, in his Vegetable Staticks, hath proved, that all evergreens perspire much less than deciduous trees; and, as they require nourishment in proportion to the quantity perspired, consequently require less. This, with their growing streight to a great height, and in a short time *, is a great advantage.

* It appeared, from accurate observations made on the measurement of twenty spruce firs, transplanted at the age of two years, to a mountainous, barren, gravelly piece of land, that they were, after standing eleven years, on an average one with another, thirteen feet, eight inches high; with stems nine inches in circumference, at two feet from the ground:—and that twenty Scotch firs, under the same circumstances, were sixteen feet ten inches high; with stems sixteen inches in circumference, at two feet

A very judicious and experienced planter of these trees, told me, "That to have them tall, streight, and clear of knots, they must be planted to shelter each other; and that, though they would not increase in bulk quite so fast, the wood would not have that sponginess, and coarseness of grain so frequent in English deal." Many of his plantations are on very side-land grounds; and the soil, in different parts cold, shallow, wet, or dry. Indeed, I have seen them grow well in almost every soil, and situation. The noble plantations of them at Wooburn, made by the duke of Bedford, are in a poor dry sand. By the side of these, they come up naturally: so that this kind of soil seems peculiarly adapted to them. A similar instance, I have seen, in that part of the kingdom, in which I reside: and, in two instances, I have seen them grow from a crevice on the top of a wall.—With us, we are far from being in that state, with regard to timber, which hath universally been complained of, by every writer on the subject. That it diminishes with us is most certain. There hath

feet from the ground. It further appeared, from the measurement of ten larches, transplanted at the age of two years, to the most northerly exposed part of the same place, that, after standing nine years, they were, on an average, sixteen feet high; with stems twelve inches in circumference at two feet distance from the ground. R. D.

been

been sad havock made, within the last twenty years. And, as we have some thousand acres of land, that bring in scarce any value to the proprietors, I could wish to see part of them converted into forests of these trees. The soil is, in general, much such as where I have seen them come up naturally: at top very loose, frequently of a red or black colour; under this often a strong soil, as favourable to their growth, when they are of some size, as the other is, while they are small.

The land may be prepared, and sown, as for wheat. It appears good management of this kind of woods, to cut off the under-branches of such trees only, as you intend to take out in thinning them. By this means, these trees may remain longer without injuring those which are to stand for timber.—I believe these trees come to perfection in fifty or sixty years. I know three instances of them much older: large trees which have not grown after that time. — I wish, I could give a satisfactory account with regard to the value of English deal. I have conversed with gentlemen, and timbermen on this subject. The latter say, the value of it is very inconsiderable: and carpenters give much the same account. By one gentleman, I was informed, that he had made good wainscot of it. By another, that he had been obliged to use it for fuel: as no one would offer him any thing

thing for it *. One, of the many advantages, that will arise from your work, is, that private individuals may procure intelligence from others, on any points material to them-

* It seems incumbent on the Society for the Encouragement of Arts, Manufactures, &c. as they are endeavouring to incite the cultivation of firs, by the offer of their honorary premiums, to have this point well decided. If the timber be not of any value, they are rather injuring than serving the public, by the measures, they pursue to increase the cultivation of the trees. If it be valuable, the removing the present doubts on that head, entertained by many, would very much promote the influence of their premium. I shall, therefore, do my utmost to procure their attention to this matter. In the mean time, I am apt to believe, that the reason of the difference of opinions in this point, has taken its rise from the variation of the qualities of the timber itself, raised in different soils and situations. General experience, and observation on the vegetation of trees, makes it evident, that the same kind standing on dry soils, and with cold exposure, if the trees retain their health, produce much harder timber than those, which, in consequence of warmth and moisture, are more luxuriant in their growth, and more replete with succulence. This holds good particularly of evergreen and terebinthinate trees.—On what principle, else, can we account for the difference of our timber from that produced, on the continent, from the same species of trees.

If the gentlemen, who are possessed of mature timber of any of the fir-kinds, will communicate their observations on this head, they shall be carefully transmitted to the public in this work: and, from a moderate ground of positive facts, this point would soon receive a sufficient elucidation, to enable us to determine, how far, and under what circumstances, the planting firs may be advantageous to the proprietor and the public. R. D.

selves,

selfes, or their neighbours. I have raised some thousands of the Scotch fir. But, as it behoves me to plant for profit, as well as ornament, I request, that some one would satisfy me with regard to the value of this timber, when of English growth. In every other respect, I am satisfied, there cannot be a more profitable tree planted.—There is another point, I want to have cleared up. Part

of the land, I intend to plant these trees in, is rather wet. In one of the foreign essays on agriculture, are the following words :

“Firs, if they only required a great deal
“of nourishment, without any regard to its
“nature, what tree ought to succeed better in
“wet or even marshy soils : as their wood
“is porous and spongy ? Yet, in such soils,
“their wood is absolutely unfit for use. It
“is well known, that, if their roots penetrate to any water, or even to a soil too
“moist, the trees begin to rot at bottom,
“before they have attained a third of their
“natural growth. Such as grow in soils,
“that are rather dry than moist, thrive very
“well : but it is certain, their wood is more
“spongy ; and does not last so long as that of
“trees, which grew in a dry, strong, or gravelly soil. The reason is self-evident. The
“juices and salts, to which water serves as a
“vehicle, do not agree with the nature of the
“wood. It requires others which can form
“a resin.”

The common Norway spruce-fir is subject to an insect, that destroys the leading shoots, and end branches. The white American spruce is said to be free from it. From its appearance, when young, I should imagine, it grows as fast as the Norway spruce.—In the moor-lands, in Staffordshire, I saw an avenue of the silver fir: and was, informed, they were about one hundred years growth; but had not increased for thirty or forty years. As near as I could guess, they were from six to eight feet round; and from fifty to sixty in height.

The wood of the larch-tree, according to the account given of it, by the very ingenious and agreeable writer of the *Essays on Husbandry*, is possessed of as many valuable qualities as any tree that grows. I have seen one, that was planted in the year 1737, which is now five feet in circumference, and above sixty in height; and others, not above sixteen years from the time of their being planted, that are now upwards of four feet round, and above forty in height. The above-mentioned writer says, “That though it grows “but slowly for the first four years; yet, in “twenty years, it will exceed a fir-tree, in “girth and height, that is of double its “age.” I make no doubt, but that so ingenuous a writer hath seen instances of it; or he would never have asserted it. However, as I knew the fir-kind were very quick growers, I took

I took some notice of the difference in growth in these trees : and I find it not so great as he hath represented. In the same number of years, they may exceed the others a third or fourth in height ; and nearly a fourth in bulk. Though I am not very certain, whether the growth of the larch is so very quick after the first twenty years. — I have measured the circumference of some Weymouth pines (my favourite trees). One, that had been planted ten years, was twenty-two inches in girth : another, planted eight years, was eighteen. They were planted when about four foot high. This is confirmed from an account of the increase, in one year, of a Weymouth pine, inserted in Marsham's very accurate Observations on the Growth of Trees in 1757. The circumference of this pine, at five feet from the ground, was one foot six inches and two-eighths of an inch : and, in 1752, it was one foot nine inches. I here recommend it to you to publish his observations in your collection ; they appear to be very useful ; and, I believe are only to be met with, in the second number of the fifty-first volume of the Philosophical Transactions : and, consequently, may fall into the hands of but few persons. I have thoughts of making the same kind of observations ; and shall communicate them to you.

I have seen quotations from a work of Dr Hamel's, *Des Arbres*. I should imagine, from this writer's very useful experiments on agriculture, that those, he hath made on trees, are not less so. I should, therefore, imagine, that you may very properly introduce some extracts out of this work into yours: as it hath not yet been translated.

I am doubtful, whether the Weymouth pine, or the larch-tree, will, in twenty, or thirty years, turn out the greatest quantity of solid timber. It is a hardy tree. No tree removes better than this does, about the end of March, or beginning of April. The year it is removed, it will make a considerable shoot. It extends its branches very wide; and, therefore, requires, as well as the larch, to stand at least a yard more asunder than the Scotch fir. I believe, it is not nice in its soil. It thrives well in the sandy soil at Woburn. If any credit is to be given to the account of travellers, or the persons I have conversed with, who have been in America, this is the noblest tree of the pine, or fir-kind.—I caution every planter, not to plant any of the above-mentioned trees single, nor in avenues, or hedge-rows. They not only, in such a situation impoverish the land; but scarcely ever make fine trees: and the bad appearance they generally have, when treated in this manner; and the injudicious method of planting them, after they are of a considerable height

height and bulk ; hath been the great obstacle to these trees not being more generally planted. If ever it were adviseable to plant them wide, the situation should be low, and sheltered, particularly from the West. — Marsham very properly recommends, to defend these trees by an out-line of beech. This tree, from its sending forth great plenty of branches, and preserving frequently its leaves during the winter, seems best adapted for that purpose.

I was pleased to find the Society have engaged with a person, who is to supply the candidates for any of their premiums, with plants, or seeds, good, and on reasonable terms*. As well as others, I have been disappointed in the seed of trees, I have been supplied with from London : and, what is worse than the trouble and expence, in vain have lost time, so precious to all planters. I think it worthy the Society to have a skilful agent in America, who should collect for them the seeds of such trees, and plants, as there is a probability of naturalizing in this kingdom ; and to appoint a person to supply gentlemen

* This refers to a *Nota Bene*, inserted by the Society at the end of the first premiums for Agriculture, in the following words : “ The trees, plants, cuttings, and seeds, for which the Society have offered the above premiums may be had of *Mr. Shields, nursery-man, at Lambeth* : who has undertaken to furnish the same, good, and on reasonable terms.” R. D.

in the country on reasonable terms, and with such seed as they may depend upon. — I am very anxious for the success of your work. The subjects it treats upon, particularly agriculture and planting, I am very fond of. Hitherto I have made little further progress in them, than from reading the best authors, and observing the event of what is practised by others.

I hope soon, however, to engage in them myself: and though my experiments may not be large, yet I intend, that they shall be in great variety: and the good or bad success of such, as seem worthy your attention, I will communicate to you.

I am, Sir, your humble servant,

A. B.

I must own, I should place a greater confidence, in such of your correspondents, as sign with their real names; and yet I have not done it myself. I have reasons for omitting it at present. Hereafter I may own this, and any other letter you may receive from me.

ARTICLE

ARTICLE XI.

OBSERVATIONS *on the Contents of a* TREATISE ON THE DISEASES OF CORN, WHILE GROWING; *written in Italian, by the Count GINANNI; and lately presented by him to the Society for the Encouragement of Arts, Manufactures, and Commerce.*

THIS work is intitled, *Delle malattie DEL GRANO IN ERBA, trattato storico-fisico del CONTE FRANCESCO GINANNI patrizio Ravennate, con note perpetue ad esso trattato, e con altre osservazioni di storia naturale del medesimo.* The author has treated this difficult and complex subject in the most learned and elaborate manner. He has consulted almost every former writer, antient or modern, known to him, who has touched either professedly, or casually, on any matter, that relates either to the cause or remedy of those natural accidents, by which corn is liable to be injured in its growing state. And he has amassed together the several opinions of these authors: adding to them his own; such as his reasoning on principles, or examination of facts, have furnished him with, on each head.

It were much to be wished, nevertheless, that the Count's experiments had been as extensive

tenfive as his reading ; and that, to obtain the due lights into this important subject, he had applied to the disquisition of nature, a greater proportion of the time and attention, which he bestowed on books. For writers in general, especially those of earlier times, furnish little on these subjects to the reader, but slight, and partial accounts of facts ; groundless and wild hypotheses ; and speculative disputes on trivial points, or frequently on such as have no foundation in the reality of things.

The just method of investigation, by an actual and expanded survey of what is really presented by nature and facts relative to the object of inquiry, is but lately introduced : and the conclusions formed on any other basis are necessarily confined, uncertain, and delusive. It is not, however, here implied, that there is a necessity, every person, who attempts to form a system of knowledge on any subject of this kind, should restrain himself to the limits only of such matters, as he is acquainted with from his own personal inspection, or trials ; which would, in general, afford only a very narrow field ; though he should always either proceed on the foundation of them ; or of those, he collects from the relations of others, which are well authenticated. But, in most of the earlier authors ; and, indeed, in too many of the later ; we see, with respect to natural history,

tory, and the philosophic doctrines which depend on it, so little regard is paid to the examination of real facts; and so implicit a deference and servile pursuit of what has been before written adopted; that the most absurd notions, which sordid ignorance and wild credulity could lead to, are introduced, and propagated.

Count Ginanni's work is, therefore, rendered much more voluminous and diffusive than necessary: a considerable part of it being principally composed of inquiries into the use and original of the names, in the antient and modern languages, of the matters he treats of; of the vague and contradictory accounts and opinions of authors respecting those matters; and of his own comments on them. But as it contains, nevertheless, almost every thing before broached on the subject; and, amongst other matters, several just observations formed on his own trials, and examination; it consequently presents the good as well as the bad; and, therefore, merits attention: as it affords room for a selection of several articles; which may yield useful information to the more ignorant, with relation to practice; and supply assistance to those, whose speculative views engage them in the pursuit of discovery and improvement.

The Count Ginanni, in this work, has enumerated FOUR *principal diseases*, to which
corn

corn is subject while growing. He calls them, LA RUGGINE DEL GRANO: — LA FILIGINE DEL GRANO: — IL GRANO CARBONE: —and IL GRANO GHIOTTONE.—It is difficult to give a verbal translation of these names into English: as neither common observation with us, nor any of our writers on these matters, have reduced this subject the same system: and we have not, consequently, any words in our language, that, according to their *general* use, answer determinately to these, which the Count has adopted. For those English names we have of the diseases of corn, are different in different places of the country; and are no where used with much precision, as to the nice distinction of one disease from another.—I shall, therefore, in exhibiting the particulars worthy notice, which the Count has advanced on each of the diseases enumerated, adopt that English word, by which we most commonly express the same disease, as far as general observation has made it known: and, where such word fails to express the whole sense of the term he uses, I must have recourse to a detail explanation. I will not, however, follow the Count's example; and take up the reader's time, by discussions on the manner, in which our writers vary from each other in the use of names: nor how far they have erred with relation to the meaning of them. Though some of our dictionaries, as well as the treatises, which

which have had occasion to mention the natural morbid accidents to which growing corn is liable, have grossly blundered both as to the words, and facts.

The RUGGINE DEL GRANO, which is the *first* kind of disease treated of by the Count, may be best translated by the word BLASTING: as being the most general name used with us to express the same manner of corn's being affected. It shews itself first by the discolouring of the blade, or stalk, in spots, or whole parts: which appear yellowish, reddish, blackish, or of a withered hue; and sometimes of all these colours, together, on different parts; or by succession in the same. It is frequently attended, also, with an unequal rising, or blistering of the outward coat; and, in some instances, with the appearance of a dusty substance on the surface. All these accidents happen at different ages of the plant: but most frequently, while it is in blade: and they terminate sometimes only in the withering of the part affected; sometimes in the barrenness of the plant, which then yields no solid seed; and sometimes in a mortal decay of the whole; according to the degree of the cause, the predisposition of the plant to be affected by it, and the importance or number of the parts injured.

The cause of the *ruggine* or *blasting*, appears, as well from the attendant circumstances of its attacking the plants, as from the particular symptoms

symptoms or effects produced, to be the inclemency of weather, either with regard to the extraordinary rigour of cold, or the too sudden and frequent transitions or changes from warmth to cold, while the vegetation is strong. The action of cold, in either of these cases, causes coagulations or analizations of the sap in the extreme parts of the plant, that are replete with succulence; or quick repulsions of it from those parts, which consist almost wholly of succulence, impelled there by the action of preceding warmth, before the fibrous organization is duly matured to bear such privation of the sap without destruction. In either of these cases partial mortification happens; the sap is depraved; and the vital power of the plant weakened in proportion: whence, the vegetable œconomy of the plant being perverted, the several consequences above enumerated are necessarily brought on.

But there is another consequence, resulting from this state of the plant, which acts as a secondary cause, not less momentous in its effects than the primary. This is the tendency of the weakness of the plant to generate animalculæ. There is nothing so clear from observation, as that this tendency is always concomitant with the weakness of vegetables. It will be constantly found, on examination, that where-ever any part of a vegetable falls into a languid state,
ani-

animalculæ are generated in it; and infest the plant, till it either die, or recover its health by the separation of the part, on the principle of mortification. In the *ruggine*, therefore, this secondary cause brings on secondary diseases, with their respective symptoms: such as blistering of, or inequalities in, the exterior surface of the coats; the powdery appearance on it; and the waste of particular parts, by a seeming annihilation, without any apparent reason.

This secondary disease not only propagates itself from one part of the plant to another; but even sometimes to the contiguous plants. It is, also, in many cases, the occasion of the destruction of plants; which would, otherwise, survive the proper and necessary effects of the first cause; and, by throwing off the particular parts, where the mortification had prevailed, regain their pristine health, vigour, and fertility.

The injury done to corn by the severity or irregularity of season, particularly sudden changes from warmth to cold, is, therefore, the efficient cause of the *ruggine* or *blasting*: but there is also a predisposing cause which greatly contributes to the effects of this. It is, a preceding weak or languid state of the plants, induced by any accidental circumstance. Such as want of due access of air: too much shade; an excess of any driness, or moisture in
the

the ground; or wharever may affect the health or vigour of the plant. For the motion of the sap being languid, the vegetative fermentation is proportionably weak; and, therefore, sooner checked or totally destroyed by the cold; and the coagulation, or stagnation of the juices in the extremities produced.

As the principal or effective cause of blasting, lies in the accidents of season, it cannot be the object of curative intention. But the predisposing cause, that is the weak state of the plants, which is in a great degree necessary to the action of the other, does admit of preventive means; and may, in some measure, be counteracted by art.

The Count has enumerated the various remedies proposed by the writers against the *ruggine*, or blasting of corn. But the greatest part of them appear, on the first view, to be trivial, or impracticable. The most common among those, which can be of any utility, is the soaking the seed in certain compositions, or solutions of salts. But it is very dubious, whether this can have any relation to the prevention of the blasting itself; though it may, as we shall see below, have some efficacy against the consequences of it, as far as they regard the breeding of animanculæ.— In the account of the remedies for this disease, to which the Count ascribes any efficacy, he first mentions the making drains to carry off stagnating waters: which, from instances

instances, he cites, contribute much to dispose corn growing near them to blasting. This notion is obviously just: as the vapours of putrid waters are noxious to many vegetables, as well as animals: and, whatever impairs the health of the plants, renders them, on the principle above specified, subject to be easily blasted. He mentions, also, the anointing the ears of the corn with oil, as being efficacious against this disease. But, however it may have appeared so in speculative experiments, nothing is more evident than, that it never can, on account of the expence and labour, of the performance, be reducible to practice in husbandry.—He recommends, with much greater reason, as an approvable means for preventing this disease, to keep the corn free from all weeds, and other strange plants: and to loosen the ground at the roots of it. This, he says, conduces so much to the preserving it from the *ruggine*, that, on practising it in several different places, he never found any corn blasted there; though it has been, at the same time, attacked by the *carbone*, or *ghiatton*: that is, *smut* and *mildew*.

It may be added, to what the Count has advanced, as to the remedies against the blasting of corn, that every thing, which contributes to the vigour of the plants, without causing a too great luxuriance in their growth early in the season, will be found beneficial in preventing it; and counteracting its de-

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destructive

structive consequences.—A good tilth of the ground, previous to the sowing, is the most effectual of all other means. The stirring the ground at the roots, at proper times, is, also, very efficacious. The drill method of culture affords, at the same time, the means; and gives space, as well as liberty from the consistence of the soil, which greatly promotes the vigour of the plants.—It must be further observed, likewise, that where too great luxuriance of growth early in the spring threatens, to make the plants too tender to bear the rigour of keen blasts of wind, the eating it down, or the depresseure of the too quickly aspiring blades, by the use of the roller, have, also, a very beneficial effect against the *ruggine* or blasting; as may be deduced from the principles above explained.—It is, indeed, as before intimated, a preventive means only, with regard to the predisposing state, that can be employed against the original, or primary disease of blasting; which has its cause in the accidents of the season, that affect the growing corn according to the state in which it suffers the attack. The secondary disease, or those consequences, that happen from the generation, and propagation of small animals, when the plants are thus injured in particular parts, or have their whole constitution depraved, will be best mitigated by the means, we shall hereafter point out, in treating of the other

other diseases of corn, which consist only in the plant's being infected by *animalculæ*.

The *second* of the capital diseases of growing corn, treated of in his work by the Count Ginanni, is called by him LA FILIGINE DEL GRANO. It corresponds, according to his description of it, with one kind of those morbid affections, that are generally called with us the *smutting* of corn. For, unfortunately, we give the same appellation of smut, also, to another disease very different in its appearances from this : and which he justly ranks as a different disease, and treats of by the name of *Il Grano Carbone*. But though these two are not commonly distinguished with us, by different names ; yet the most sagacious of the modern farmers, nevertheless, have observed them to be different. From Mr. Reynolds's account of smut, given in Article IX. of this Volume, it further appears, that, in the part of Kent where he lives, the *carbone* is called *bag-smut* : and he has given the name of *loose-smut* to the *filigine*, or kind, we are now treating of. I shall, therefore, adopt those names here : and, to preserve conformity, call the *filigine*, LOOSE-SMUT : and the *carbone*, being already termed bag-smut in some places, I shall retain that appellation for it.

The Count declares, the loose smut to be, according to his opinion, an internal disease of corn ; and describes it with accuracy. He says, that

it attacks the ear only, most generally in its earliest state, before the grains are distinctly formed; and while it is yet inclosed in several *involucra* or coverings, constituted of *folliculi*, or very thin coats of a soft tender substance; which afterwards grow thicker and stronger; being designed to secure the young ear with the rudiments of the grains from internal violence. The rudiments of the grain, in consequence of the effects of this disease become wholly, or in part, corrupted and blackish: and, when the ear is grown bigger, and come out of the *involucrum*, which inclosed it while young, the corrupted matter becomes solid; and so dry as to resolve itself into a fine impalpable powder of a fetid smell, that flies away with the wind, or any other motion. The stem of the ear is then left bare, whole, sound; and, sometimes, green, juicy, and plump. Before this happens, the appearance is an irregular formation of the top of the stalk, or straw, which seems to grow gradually thicker, and shews the young unformed ear, for the most part wholly of a black colour; intermixed with white follicules, so loose, that, with the least rain, wind, or any other motion, they are carried off, together with the blackish powder, which they supported. It is proper to observe, however, that the *filigine*, or loose smut, is rather of a very dark chesnut colour than black: and the nearer it is found to-

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wards the bottom of the ear, the more it appears discoloured. It is also, sometimes of an ash colour; and like that of a decayed olive.

The description given, by the Count Ginanni, of the *filigine* agrees perfectly with what Mr. Reynolds has remarked of the loose smut: who says, that this powerful
 “ enemy never fails to make its appear-
 “ ance in the field, when the grain is
 “ coming into bloom; and is seen at no
 “ other season but when the corn is ge-
 “ nerating:—We may behold, at this time,
 “ the habitations of these animalculæ (*for he*
 “ *ascribes the whole effect to animalculæ*)
 “ broken down, and shattered all to pieces;
 “ their provisions gone; and the whole ear
 “ devoured; nothing being left but the
 “ black dusky particles, intermixt with the
 “ eggs, and progeny of such insects, as
 “ brought on the cause: the product or sub-
 “ stance, of this smut being blown away, little
 “ or none of it comes into the barn to affect
 “ the grain with blackness: as the other or
 “ bag-smut does.” It is evident from hence, and from what we shall below observe of the Count’s description of the *carbone*, that the distinction of the loose-smut, and bag-smut, as noted by Mr. Reynolds, corresponds entirely with that of the *filigine* and *carbone*.

In treating of the *filigine* or loose-smut, the Count Ginanni mentions the opinions of various authors. These opinions, neverthe-

less, are only so many hypotheses formed on notions of the vegetable œconomy, respecting the nature of the sap, and its motion; or the construction and action of the solid parts of the herb: and they, by no means, agree with the facts and principles, which the later more accurate observations have established since the improvement of physiological knowledge. He leaves the original cause of this disease, therefore, unexplained; and only attempts to shew, by the appearances he describes, the progress of its effects on the herb and grain.

It is extraordinary, that the Count should not have taken under consideration, how far there may be ground to believe this disease has its origin in animalculæ. But he is wholly silent as to that point: though it is evident, that the *filigine* is contagious; and that the contagion, residing in the grain, communicates its effects to the plants produced by other grain which have come in contact with such as are infected. This suggests the generation of animalculæ to be the means of such contagious communication; though it has not been hitherto actually observed: and there are other circumstances in the appearance of this disease, which support his opinion.

Though the Count has wholly overlooked *animalculæ*, as a presumptive cause of the *filigine*, Mr. Reynolds, in his account of the smutting

smutting of corn has pronounced boldly, from the manner in which the appearances of it strike his imagination, that animalculæ only are the cause of both kinds of it, without entering more deeply into the disquisition of the arguments for or against such an opinion. Among the reasons for inclining to the belief, that animalculæ are the cause of both kinds of smut, there is one of very great weight. —The loose-smut, as well as the bag-smut, affords a considerable quantity of volatile alkaline salt on distillation; which the Count himself mentions in another case to be a proof of the presence of animal substance. It may, indeed, be objected to the inference, I would draw hence, that some plants do, in their distillation, afford volatile salt from their own proper substance when not diseased. But this, by no means, holds good of such plants as yield fixt alkaline salt on their incineration: amongst which must be ranked corn while sound. It is evident, consequently, there is some additional matter to the proper substance of the grain, which produces the volatile salt; and that must be presumed to be, either animalculæ themselves; or their ova or excrements. The production of volatile salt in the distillation of smutted corn is, indeed, almost as great a proof of the presence of animalculæ, as the actually seeing them would be: since no change in the natural parts of

the plant while growing, would bring on the property of affording such salts, according to the known laws of chemistry.

The assigning the cause of the *filigine*, or loose-smut to the animalculæ generated in the rudiments of the grain, and destroying the tender parts of it is, therefore, well justified. For neither mechanical defects in the construction of the parts of the plant, preventing a due transpiration, or causing morbid ferments, from both which the cause is attempted to be explained by some; nor the accidents of season, to which others impute it, can possibly account for the contagion, or the production of the volatile alkaline salt: which, on the other hand, are very satisfactorily solved by the supposition of the animalculæ; that would of course produce both these consequences, and the other effects of the smut in corn.

In treating of the remedy against the *filigine* or loose-smut, the Count Ginanni determines almost as little, as he does with respect to the cause. He speaks of the sprinkling the blade, while young, with spirit of sal ammoniac, and mixtures of similar saline bodies: but he justly condemns it in practice. He recommends nothing, but the sowing all the grains of corn at a distance from each other; keeping the ground clear of weeds; and avoiding the ploughing some lands in time of bad winds.

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The sowing the grains at a distance from each other, the first of the remedies enumerated, will certainly contribute to the vigour of the plants ; and so will the keeping them free from weeds. But it is not practicable, in large culture, either in the drill or broadcast methods of sowing, to prevent unequal distances in the grain sown ; nor, indeed, can any means effect the placing the grains at equal distances but the setting them separately with the hand. In sowing either by the hand or drill-plow : it is impossible to obtain a regularity of distance in the grains to each other ; and though, by a great diminution in the quantity of seed sown, there would be necessarily more space between the plants in general ; yet the reducing it to less than a certain proportion, with regard to the fertility of the soil, would occasion an intolerable defect in the crop. This remedy, therefore, cannot be applied in practice ; though it may appear to avail in experiment, where the grains may be set with exactness at any desired distance.

The keeping the ground clear of weeds, the next remedy against the loose-smut, proposed by the Count, is certainly one means of lessening the smut ; as whatever weakens the plants has a tendency to promote the bad effects of it. But it is only a mitigative remedy. For, if the causes of smut, and the other circumstances that tend

to encourage it, subſiſt any-where, the clearing away the weeds, will, by no means, be ſufficient to prevent its being very prevalent.

The avoiding to plough lands of a certain quality, during the time of pernicious winds, is the laſt remedy mentioned by the Count, as efficacious againſt the *filigine* or looſe-smut. The antients, he ſays, paid great regard to this caution, and with adequate reaſon. If there be, nevertheless, any real ground for the notion, that plowing the ground, while the wind is in a particular quarter, can be of any effect in producing diſeaſes of corn afterwards ſown in ſuch ground, it muſt ariſe from a local cauſe; and, moreover, cannot extend to the looſe-smut.

The known principles of physics do not lead us to believe, that the air itſelf, in whatever direction its motion may be put, can impregnate the earth with any quality injurious to vegetables: and experience has ſhewn, alſo, that land, inſtead of being depraved, is improved in its fertility by expoſure to the air. It muſt, therefore, if the fact be true, that particular winds do impart qualities to the earth, which contribute to the diſeaſes of corn, be owing to their conveying, from one place to another, ſome peculiar matter capable of producing ſuch effect: and this matter not being general to
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the air, can be taken up, by it, only in those places where it abounds. Particular winds, therefore, only affect particular places aptly situated, with respect to some others from whence the noxious effluvia are brought by such winds: and, consequently, this action of winds must be local and confined to those places. — But if we consider of what nature the effluvia are, which may be thus conveyed by winds, from one place to another, and impregnate the earth with qualities injurious to the health of plants, we shall find it can be only animalculæ of the fly kind: which, being generated in a more abundant manner in particular places, may be carried by winds to others; and there, dispersing their ova in the ground, fill it with their breed in such a degree, as would not happen, if they had not been thus conveyed thither by such winds.

—Hence, in the ensuing season, the grain may suffer greatly in the herb, from these animalculæ, while in their chrysalite state.

—The places where great numbers of such animalculæ are produced are marshes, bogs, and grounds lying contiguous to stagnated waters: which keep up continued breeds of such small animals; that only migrate through accident into other places.

But this principle does not reach the production or augmentation of smut in corn: which, tho' probably animalcular, is a species different in its œconomy from the kinds thus

generated in, or near, stagnant waters. Experience, likewise, with us, gives no room for imputing the introduction, or increase of smut, to such a cause: and, if the ancients had any foundation for their notion, that ploughing during particular winds, induced qualities in the soil pernicious to corn, it must be bringing other diseases on it, which they confounded with smut; and not the smut itself.

In a note, the Count mentions, as an opinion of others, that macerating the seed-corn in lime-water is a preventive remedy against the *filigine* or loose-smut. But he declares it to be his own opinion, founded on some trials where this method did not appear to succeed, that it is not of any avail against that species of smut: though he deems it efficacious against the *carbone* or bag-smut. A much larger field of experience, and observation with us, shews, nevertheless, that the Count erred in this matter, by making conclusions from too slender premises; and that lime-water is very serviceable against both kinds of smut. Indeed, if we impute both kinds of this disease to animalculæ, the reason, *à priori*, why lime-water should be efficacious against both, is very evident: which is, that the cause of its action lies in its caustic power, by which it destroys the minute animals, or their *ova*.

The maceration of corn in a solution of sea-salt, which is commonly called BRINING, is a still more efficacious palliative of the loose smut than the use of lime-water: though it is wholly omitted by the Count. How far the brine acts on the corn, in destroying what produces the smut, is a point not hitherto very clear. But it is certain, that it affords the means of separating the light grains from the sound; and among the light grains, are those, which are contaminated by the infectious matter of the smut to a certain degree, without being so injured as wholly to lose their vegetative power: and which consequently are the medium whereby this disease is propagated among the growing plants. It is now known, that the liming and brining may be performed with advantage under one operation. But of the effects, and best method of practising the brining, either singly or with lime, we shall have occasion to speak more at large in speaking of the next of the diseases, the Count has enumerated.

The THIRD of the capital diseases of growing corn, treated of by the Count Ginanni, is called, by him, IL GRANO CARBONE. It answers, as before-mentioned, to the kind of smut, named, in some places with us, the *bag-smut*. He says it is "an internal
" depravity of the grain, of a most destruc-
" tive nature, which constitutes that disease,
" seen,

“ seen in the whole, or part of the grains of
“ the ear, at the time when the ear is en-
“ closed in its pannicle; and the grains are
“ intirely and strictly covered with their
“ *folliculi*: and which makes the grains
“ deviate from their natural form and be-
“ come of twice the usual length, and with-
“ out a point; renders their skin, or coat,
“ very smooth, and easily yielding under the
“ teeth; makes them thicker than ordinary,
“ and full of a fluid matter of a black tinge,
“ extremely fetid; which, growing dry,
“ resolves itself, by degrees, into a powder,
“ while the hard skin, or coat, becomes easy
“ to be broken by the ends of the fingers,
“ or cracked by the least pressure.” It may
be added to this, that these grains, breaking
among the sound grains, when the corn
is threshed, give them a black hue on the
outside.

This disease is, without doubt, specifically
different from the other species of smut, cal-
led the *fligine*, or loose smut. For, though
the Count seems inclined to think, it is only
a variety, or perhaps, a different degree of the
same, he himself produces facts, that show it
really and absolutely of another kind. The
principal of these facts is, that there are
places where, though the *fligine* can be
proved to have been for many ages past, yet
the *carbone* was never known till of late years.
This evinces, that these diseases are not a dif-
ference

ference in degree of one only: because the accidents, which may have been supposed to have aggravated the *filigine* into the *carbone*, must have happened formerly as well as lately, in so long a course of time, as corn must have been cultivated in the places where it was not before found.—The same may be, likewise, said, as to its being a variety, arising out of the other kind. For it could scarcely have been produced in so many other places, and not have emerged here, in so great a length of time.—It is the transportation of a new contagion to these places, by bringing some infected corn from elsewhere, that alone can naturally, and clearly account for the introduction of the *carbone*: and this, making the case not to depend either on local circumstances with respect to any peculiarities of the soil or wind, nor on general properties in the herb itself, will lead us to infer more strongly such cause to be really that, to which, for other reasons also, we shall ascribe it below.

In treating of the cause of the *carbone*, or bag-smut, the Count Ginanni ascribes it to “an organical defect, which consists in a less perfect and naturally weak texture of the fibres of the germs of the seed itself.”—He sees, however, the difficulty, that results from the not finding the effects of this cause more constant as to time and place: and he says, that by a good constitution of the air, regular

regular and kindly winds, and exterior aid, this weak power of the fibres may be counteracted; and that they may be strengthened, so as to admit of the corn's attaining to perfect maturity.—He, likewise, labours to account mechanically for the manner, in which the weakness of the fibres produces the appearances found in grain affected with this disease: and he endeavours to illustrate his hypothesis, by similar effects of weakness in other parts of plants.

But, after all, the Count's notion of the cause of this disease is merely conjectural, according to his own arguments; and evidently erroneous, considered with relation to other facts, and known principles, which he does not bring in question: as every supposition, that does not square with established truths, must be deemed repugnant to reason.

That the *carbone*, or bag-smut, is contagious is evident, from the most extensive observation. Many places are known to have been free from it, till it was carried to them by infected grain: and it is well known, that such grain mixt or sown with sound corn, will seldom fail to propagate the disease to it. These effects can never be accounted for by mechanical defects in the rudiments, or the bad structure of the germs of the diseased grain: the consequences of which would be confined to them; and could not be imparted to others, and propagated in
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succession. There is, moreover, another fact, said on good authority to be established by observation, which raises equal difficulties to his opinion. It is, that, if a quantity of this kind of smutty corn be divided into two parts; and the one sown the next season after it is reaped, and the other kept to the third year, and sown then, such part as was sown while fresh will produce smutted corn in the crop; and the other sound corn, wholly free from smut. It is obvious, therefore, that this disease generates some contagious matter, which propagates it: and, consequently, it cannot have its original in the male-formation of the parts of the affected grain.

Though the Count has adopted the hypothesis of a mechanical cause of this disease in grain, as his own opinion, yet, in speaking of those of others, he mentions the notion of its being caused by animalculæ. If we consider the circumstances, above-mentioned, of the conveyance of this disease by infected grain to places where it did not subsist before, and the propagation of it thence through the adjacent parts;—reflect, likewise, in how many instances, indeed, all where we have the means of due examination, the contagious diseases of the vegetables is known to be owing to animals;—and admit the force of analogy;—we shall see the justest reason for allowing animalculæ to be the cause of bag-smut;

smut : nor can we find any other principle that is in the least apt or adequate.

Mr. Reynolds, in one of his letters contained in *Article IX.* of this volume, without hesitation, asserts both the kinds of smut to arise from *animalculæ*. He says, page 135,

“ And I dare pronounce, that both these disorders proceed from a like cause, which is
“ the infection of insects, or some kind of
“ small animals, such as the learned call
“ animalcules ; generated in the plants, and
“ from no other cause whatever.” In page 137, he further says, speaking of the *carbone*, or bag-smut : “ The other incrusted,
“ enemy, or bag-smut brood, act, indeed,
“ more privately ; and occasion the greatest
“ disorders among wheat when it comes to
“ maturity. Because it renders it odious ;
“ and sometimes totally unfit for bread.
“ These vermin, stick on the outward coats,
“ for wheat has two coats, during their
“ abode in the corn : especially after threshing : when the bags are broken ; and the
“ grain becomes mixed. Their existence is,
“ however, but of short duration ; for, unless the grain be committed to the earth
“ in due time, they certainly perish. Because we find, from well-grounded experience, that old seed sown in its natural
“ state is free from smut in the next generation : as numbers can witness. And
“ we

“ we have recent instances to confirm this,
 “ even in the last year. For none of the fo-
 “ reign wheat, that was one, two, or thre
 “ years old, sown in these parts had any such
 “ disorder. — But with new seed the case is
 “ manifestly different. The enemy stands
 “ at the door of vegetation; passes along
 “ when it is open; unites afterwards, as the
 “ plant advances, with the floury sub-
 “ stance designed for food; and, in the end,
 “ devours that matter, which would other-
 “ wise become flour in the grains: leaving,
 “ instead of it, a noxious black powder in-
 “ fested with the eggs, brood, and excre-
 “ ment of the insects. Hence comes the of-
 “ fensive smell.—This accounts for the dis-
 “ ease; and shews us pretty plainly, that it
 “ proceeds from insects, and vermin, &c.
 “ only.”

We may, therefore, advance on very safe grounds, that, if we cannot prove, by the evidence of the senses, the bag-smut is caused by animalculæ, we may conclude it from the effects, and from analogy: and the rather, as there is another disease of a similar kind, in which the cyst, or cavity in the corn, containing the smutty matter, is much more strongly defended by the coat; but being broken open, and the contents macerated in water, very strong active animalculæ are brought to life, or revived, even though the corn has been kept for twenty years.

In treating of the remedies for the *carbone*, or bag-smut, the Count Ginanni is very concise, though he enumerates five different means.

The *first* means of cure he proposes is of the preventive kind; and consists in the breaking and stirring the ground well before the sowing the grain: and which, he says, will bring forth that spirit, which strengthens the fibres of the seed; and enables them to make resistance, and defend themselves against it.

As a *second* means, he declares, that the use of stable-litter, or dung, will much contribute to promote the foregoing intention by furnishing a copious quantity of the spirit, which invigorates the plant.

This is, in fact, only recommending tillage and manure, which giving strength to the plants, and producing a vigorous state of them, will, it is well known, render them less subject to the attacks of any disease. But this species of remedy will, of course, be employed by every farmer, for other obvious reasons; and, therefore, needs but little recommendation to enforce its practice on this account.

In the use of manure, where there is danger of smut from other circumstances, care should be taken in the choice of it. For nothing has been found to contribute more to the increase of smut than the use of fresh

stable-dung, and litter, when laid on the ground in a mouldy state, without sufficient previous rotting.

The Count admits, however, that this kind of remedy is only palliative : and that it does not wholly prevent, or destroy smut. He, therefore, proceeds, to the following : which are, such as are said to be more absolutely effectual.

The *third* means, he mentions, is the soaking of the seed in lime-water : which, he declares, he has found of some service ; but not a certain and absolute remedy against this species of smut.

The use of lime is now become very general, from the experience of its being considerably efficacious against smut : and it is much practised now, also, to *brine* the seed, as is called, before the sowing. This is, the soaking the seed in water, to which sea-salt has been added. When brining is practised, it is common now to mix some lime with the seed.

There are various other ingredients, and compositions ; such as solutions of nitre, sal ammoniac, and vitriol ; urine ; ley of ashes ; mixture of horse-dung and water ; used for this purpose, both in Italy and elsewhere, as the Count observes in his notes. These are called *salamoje* ; and the greatest part have been tried, and exploded in most countries, where improvements in agriculture have been attempted. The use of a solution of

sea-salt simply, with us called *brining the corn*, and of lime, has, however, from universal observation, been found of great utility; and, therefore, merits consideration, as a remedy for the smut: though, perhaps, we have not hitherto sufficient authority for believing, that it is infallible in any mode of practice of it.—Mr. Reynolds, nevertheless, gives us encouragement to hope it may be so. In the method, he has communicated to the Society for the encouragement of arts, &c. which is contained in *Article IX. of this volume*, he has joined the use of lime and sea-salt in one operation: and he says, that it has always succeeded with him for thirty years together, in a great variety of soils, and on large quantities of land.

That lime destroys smut, or in some manner counteracts the effects of it, is certain. But it has been doubted by some, whether brining has any consequence in that view, besides the giving an opportunity for the separation of the grains, that are infected in a more considerable degree with any disease, from the sound: which becomes practicable from the increased specific gravity of the fluid, that renders such grains, lighter than the sound corn, more buoyant, and disposed to float on the surface: whence they may consequently be skimmed off. It is highly probable, nevertheless, that the maceration, or soaking of the corn in salt and water, has
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some other operation in preventing smut: which may be, in aiding the due vegetation of the plant; that would, otherwise, be imperfect from the injured state of the seed. There is reason to conclude, that the salt imbibed may prevent the rotting of the coats of the seed before the proper change be made in the farinous part, for promoting the vegetative efforts of the planticula, or seed germ, by checking the fermentation, that causes these efforts, in changing the *farina* into saccharine juice: which is probably too rapid in the grains injured by disease, where the fibres that contain the *farina* are broken or corroded.—It is probable, that lime acts in the same way, in preventing smut, by checking, the too quick fermentation in the seed; as well as by destroying the *ova* or brood of *animalculæ*: supposing the cause of the disease to consist in them.—Mr. Reynolds's method of joining the liming, and brining in one operation, has some peculiar conveniencies, which are pointed out in the notes, *page 131 and 132, of this volume*. But whether so small a quantity of lime, as is absorbed in the soaking in lime-water, is equally effectual with that quantity which is buried with the seed, when the dry lime is used in a solid state, seems to be an undecided question. Mr. Reynolds' assurance, that this method never failed in a great number of years and very

extensive application, is a greater authority than has been advanced, or, perhaps with truth, can be advanced of any other method. It is, moreover, easy in practice for any purpose: and particularly accommodated to the drill method.

The *fourth* means enumerated by the Count, and from which he asserts, he has found equal advantages to those already mentioned, is, the infusing the grain in the washings of the marc, or pressings of grapes, made pretty hot; or in the *feces* of oil well dissolved in the lixivium used for soaking the olives. This practice is not so suitable here, where wine is rarely made from grapes; and oil never from olives. The operation of these substances, as a remedy for smut, is probably the same with that of the lime and sea-salt: and there is not the least reason to believe, they are more efficacious. It is not, therefore, a matter of any regret, that we have not the opportunity of employing them.

The *fifth* means the Count speaks of; and which, he says, he has, perhaps, found the most efficacious of any; is to sprinkle the powder of sulphur, with us called flour of brimstone, over the seed-corn; and to mix, and shake them, several times, together. He adds, This method has been attended with such success, that, in his trials, since his use of it, he has never seen the grain, produced
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in the fields where he makes his experiments, attacked with this disease.

There is great reason to believe, that sulphur may act on the grain, and the contagion of the smut, in the same way, as lime or common salt; and probably with greater power. The use of it is commodiously practicable; attended with very small expence; and requires less time than brining. It were, therefore, to be wished, that further experiments were made on this method: as, if found effectual, there are cases where it would be found more convenient than brining, and lime. And there is great reason to believe, that sulphur might preserve the seed from the attacks of other small animals, as well as the smut.

The *sixth*, and last means of remedy against the *carbone*, or bag-smut, recommended by the Count, is, the plucking out, and taking away all the smutted ears, while the corn is growing: which, of course, prevents their damaging the grain of the sound ears after the reaping. This, he says, is easily practicable, by the farmers, and their servants, by going over the fields when the grain is near ripe, at which time, the disease shews itself very conspicuously. It is certainly one way of preventing the mischief of the smut: but, however easy it may be in the Count's country, or other places where farmers have only small quantities of corn, and plenty

of hands, it could not be made to answer here in large tracts of corn-land; and where labour is dear. This method would be, consequently, a bad substitute for some of the foregoing: which, if duly practised, would prevent in a great degree the occasion for it, with a very small part of the expence and trouble.

On the whole, therefore, the use of bringing and liming in the broad-cast tillage, and of Mr. Reynolds' method in the drill-culture, are those, which experience has hitherto shewn to be most efficacious and certain. The use of sulphur, should further experiments confirm what the Count's trials have offered to his observation, would, perhaps, be preferable to those methods: but a much greater basis of experience than is yet displayed to the public on this point, is necessary, in order to give a just ground for such a determination.

The *fourth*, and last of the principal diseases of corn, treated of by the Count Ginanni, is called by him IL GRANO GHIOT-TONE: by which name is meant that manner of corn's being affected, that is named, with us, the MILDEW.

The Count describes the *grano ghioppone* to be an internal disease, which changes the figure of the grain, as soon as the ear comes out of its *involucrum*, or covering; makes it grow more than ordinarily, but yet unequal-ly,

ly, round ; and renders it of a greenish hue, till it become dry ; when it acquires a dusky lion colour ; has a rough coat ; and is easy to be broken by the teeth. The grains being then, likewise, of various sizes : but always less than corn while green : some being only of the bigness of black pepper ; and others of laurel, bay, ivy, or juniper-berries : and these grains do not contain any farinous substance ; but have within them a fibrous matter, exceedingly white, of a pliable consistence, very easy to be broken, and resembling talc in appearance ; which fills the cavity of the *matrix* of the grain formed by the inclosing membranes.

Our countryman Needham says, “ the mildew is a disease of corn, that destroys the farinous substance within it ; and introduces a foreign matter ; which discolours and blackens the grain, at least externally. This matter is either a powder, black and very fine, but of which the parts viewed in a microscope, have not any uniform figure ; or a white substance entirely composed of long fibres packed together ; and which do not give any sign of life or motion if they be subjected to the microscope, as they are taken out of the grain, without applying any moisture to them.” It is evident here, that Needham confounded the *carbone* or bag-smut, with the mildew ; and supposed the same disease

disease produced the black powder, and the white fibres: though, if he had attended carefully to the appearances in the grain affording each of these substances, as to their magnitude, form, and other particulars, he would have perceived a constant difference; and, of course, concluded them to arise from a different cause. The Count has been more accurate; and rightly distinguished them. He has separated the real changes, resulting from the cause of the *ghiottone*, from the others owing to different causes: and which are, nevertheless, both, by common observers, and even some of the best of our writers, ascribed to the mildew.

With respect to the cause of the *ghiottone*, the Count declares himself ignorant of the time when the corn is first affected by it: and he says, it would be a chimerical pursuit to seek the discovery of it. Some accurate and sagacious observers with us have, however, supposed it to be when the corn is in flower: and, as it is very probable, that the injury done to the *farina fecundans* is the cause of this barrenness, and other changes in the grain, which are found to be the consequences of this disease, we may reasonably allow such a conjecture to have some foundation.

As to the nature of the cause of the *ghiottone*, the Count determines nothing: but he declares, that he thinks it a rational hypothesis, to impute it to animalculæ. He even
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takes great pains to prove philosophically, that it may be so, by removing the difficulties which might be brought, with relation to the animal œconomy, against this supposition, on account of the extraordinary circumstances under which these animalculæ must subsist before the herb attains a more advanced state of vegetation. But this seems needless. For, though nature appears to observe analogical laws in general, as to the structure and vital œconomy of animals; yet it is with almost infinite variety and latitude: and they are generated, and live in situations, that break in upon general rules almost to the degree of a direct opposition. Such are those animals, even of very considerable magnitude, that are found in the livers of various diseased beasts; the worms which grow to an exceeding great length betwixt the muscles of men; and many others.

But the difficulty the Count labours thus to remove, on the score of the state of the animalculæ in the corn, before they shew themselves by their effects, has possibly no existence in fact. That the *ghiottone*, or mildew, does proceed from the injury done to growing corn from animalculæ, there is very little reason to doubt. But it may well be questioned, whether those animalculæ, have their seat in the grain itself; or, as he supposes, some other part of the plant, by the mischief done to which,
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the grain may be secondarily affected. I have above mentioned, that the cause, of this disease, as far can be collected from appearances, seem to act first about the time of the flowering of the herb; and that it is not improbable, the change produced in the grain, may be owing to the destruction of the *farina fecundans*, which should impregnate it, and produce its perfect state.

There will be the more reason to incline to this hypothesis, if we observe, that, about the same time, the external effects of the mildew shew themselves in other parts of the plant; and with such a strong and quick change in them, as is much more consistent with a general external cause, acting on the exterior parts of the plant, than an internal one. This, indeed, is so evident, particularly in the exudation, that vulgar observers ascribed it, as they are apt to do, the manna and all other appearances of that kind, to something which falls from the atmosphere on the plant. If we, therefore, impute the effects to insects attacking the exterior parts of the plant, the flower would, in common with them, be exposed to the mischief: and the *farina fecundans* being destroyed or injured, the grain would necessarily become affected and imperfect. That this disease is owing to some external cause, which prevails at the period we have mentioned, is, also, rendered more probable from the observation, that

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corn, which, from being sown in the spring, instead of autumn, or from any other cause, is kept backward in its growth, and does not flower till late, is much more subject to it than such as more early attains that state.

The Count seems, with others, to suppose the *ghiottone*, or mildew, like the two kinds of smut, to be infectious. But there is not the least ground of observation for such an opinion. The mildew is found promiscuously every where, in a greater or less degree, according to the accidents of the season, or the particular state of the growing corn; and does not appear to be conveyed by grain affected with it to places where it was not found before: as is evident in the case of smut. The reason of this difference is easily assignable: allowing even the mildew, as well as the smut, to arise from *animalculæ*. For, if the other parts, and not the grain, be the nidus and place of habitation of the *animalculæ*; and the grain be only secondarily affected, and changed; the *ova*, or the *animalculæ* themselves, will not be conveyed with the grain; nor consequently propagated along with the seed-corn: as is the fact, with regard to those that produce the smut: which are bred and inhabit in the grain. It is, therefore, highly probable, that the grain itself is not the seat of the *animalculæ*, which are the cause of those appearances called the mildew: as it is not

not found infectious : and, admitting this, the reason of its not being infectious, like the smut, results obviously thence.

The Count Ginanni, however, has adopted the notion, that the grain is infected, and contains a contagious matter that will propagate the disease with the seed. In consequence of this, in treating of the remedies for it, he concludes, that the means of preventing it must lie in the destruction of such contagious matter in the seed-corn. The first method he mentions for this end is, that dictated by our own countryman Bradley : who directs the steeping the seed-corn in a strong brine, with some alum dissolved in it ; and then washing it well in fresh water, and separating the light and imperfect grains. But the Count admits, that, on the most careful trial with all the precautions recommended by Bradley, he did not find this practice succeed, as to the *ghiottone*. It is not, indeed, to be wondered at, that it should not. For, if the production of this disease depends on some exterior cause, attacking the corn at a certain season, and not on any infectious matter in the grain, it can be of no avail here ; though of considerable efficacy against the propagation of the smut.

The next remedy of this kind, the Count speaks of, for the *grano ghiottone*, is the keeping the grain, suspected of the infection, a long time in powder of arsenic. This, he

he says, will kill the small animals in the invisible cavities of the grain; and is a certain method of rendering the corn fertile by freeing it from them. The effect would probably ensue, if the mildew did really depend on *animalculæ* in the grain. But, as from the reasons above-mentioned, it may be concluded that it does not, this treatment of the corn may be justly presumed to be of no consequence against that disease. There is just reason to presume, that arsenic would be of efficacy, in destroying *animalculæ*, and minute vermin, which do injury to corn, by various ways of application: and there are authorities for believing, that it has on trial been found to improve fertility in a very considerable degree. But the danger, and inconvenience, from its very active virulence, of bringing it into common use; and, indeed, the expence of employing great quantities; are strong reasons against its introduction into general practice.

The last remedy, the Ccunt mentions; and which, he says, is the most certain and easy that can be suggested; is the picking out, and taking away the ears affected with this disease, while the corn is still growing.— Besides the observations before intimated, in speaking of this method, as a means of prevention of the *carbone*, with relation to its impracticability in large tracts of corn-land, it would be of no benefit in prevention of the
mil-

mildew, unless that disease be really propagated by contagion with the seed-corn. But, this not being admitted, it stands on the same footing, as the other means we have just spoken of; and must be deemed of no avail.

The mildew appearing, on fair ground of observation to be owing to some exterior cause, acting at a certain season after the corn is considerably advanced in its vegetation, all means of prevention by any change made in the seed, with a view to the destruction of animalculæ, must, of course, be inefficacious. The only principle, on which there seems to be any ground for preventive means, is the bringing the corn so forward, by early sowing, or good tillage, as to render it strong, and moderately early in the time of flowering: as weak and backward corn is more subject to the attack than such as is vigorous and duly forward. — If any remedy can be applied when the cause of mildew is actually operating on the herb, it will most probably be found to be by smoking it with smothering fires, made with dried weeds, or other vegetable matter placed to the windward of the ground on which the corn grows. Allowing, as there is great reason to believe, that the mildew arises from the attack of flights of some very minute fly, or insect, the smoking the places where the corn seems affected with it, on the first appearance of any symptoms of the disease, may, probably,

probably drive off, or destroy such flies or insects : as it has been found to do others of a similar nature. — This seems the whole, that can be done against the *ghiottonè* ; which comes on invisibly ; and is not, so far as we know, like the cause of smut, which lurks in the seed, and may be there destroyed, within our reach, till it acts on the growing herb, and makes its mischievous ravage.

Besides the four *capital* diseases of corn above treated of, the Count Ginanni enumerates several others of lesser consequence. These are first IL GIALLUME : for which we have no correspondent term in use with us. It shews itself, according to the Count, sometimes in a thick yellowish matter within the coat, or in the grain itself ; or on the leaves : or in spots, first of a whitish green, then yellowish, and last a reddish brown colour, succeeded by a dryness. These appearances are evidently the effect of some species of blight ; either a less degree of the RUGGINE before treated of, or some other, arising from a similar, though more partial cause : or they are the consequence of an accidental injury received by the plant from some insect, or other animal ; or from the rigour of the weather. — The Count specifies as one cause of this disease, the sulphureous vapour peculiarly found in certain soils. But there is no room, from adequate observation, to admit this notion : though there are not

wanting authors who advanced it before him, of this disease. For, as only particular parts of the plant are affected with the symptoms, the appearances do not agree with the supposition of so general a cause: and, indeed, according to the description the Count has given, it cannot be properly considered as one disease of the herb; but as the symptoms of a topical disorder of the parts, which may result from any accidental injury done to them.—The Count, with reason, acknowledges the impracticability of preventing, or removing the *giallume* from growing corn; unless that kind of it, which is of the same nature as the *ruggine*: and which, consequently, admits of the same remedy.

The *second* of the diseases of inferior note, mentioned by the Count, he calls IL GRANO VORO: which may be translated *empty grain*. The name itself, as he observes, gives the definition of the disease. He endeavours to investigate the causes of it; but pursues that inquiry only by conjectural speculations on the manner, in which the grain may be deprived of that nutriment, requisite to the formation of its internal substance. — The Count confesses, that, after many experiments to find one, he is as ignorant of a general and effectual remedy for this disease as for the *giallume*; except where it is owing to injury done to the stalks by vermine: in which case, those means which preserve them from the vermine of course avail. The

The *third* of these diseases of inferior note, mentioned by the Count Ginanni, he calls LA STERILITA DEL GRANO : in English, *the barrenness of corn*. It is found when the plants vegetate, and appear healthful in the leaf ; but do rise only to a small height : and the ear does not flower ; or fails in bringing forth perfect grain. The Count properly imputes this disease of corn to the faultiness of soil : which may be various ways unsuitable to the corn.—The remedy for it, of course, lies in the correcting or amending the faults and defects of the soil : which must be done by those usual means, the particular nature of it dictates. The Count recommends, also, for that tendency to this disease, which appears when the grain becomes smaller and smaller, every year in the same place, owing to the natural poverty of the soil, as in mountainous grounds, to change the seed every year. He adds that, bathing the root, in a mixture of equal parts of milk and water, will preserve the corn from this disease : as he says, he has found on actual proof by trial. But this, however true in experiment, is not reducible to practice, even for the obtaining seed-corn, where considerable quantities are wanted. It is, however, of great consequence to the crops, to procure large and perfect grain to be sown in places where it appears the seed degenerates in this manner.

The *fourth* of the inferior diseases of corn specified by the Count Ginanni, is named by him LA LUSSURIA DEL GRANO: in English, *the luxuriance of corn*. It is, as he says, a species of barrenness: because, in consequence of its overgrowth, the herb bears down to the ground; and the grain is longer than it ought to be; but with very little pulp and farinous substance. Besides other inconveniencies that attend from what is called the *laying of corn*. — This disease arises from the faultiness of the soil, as well as the other kind of barrenness; and must have its remedy in the correcting the quality, which occasions it. But there is, also, as the Count mentions, an occasional cure for this, which the other does not admit of. It is to be practised, when the corn is first perceived, in the spring, to rise too fast, by putting a flock of sheep into the field, to crop the tender blade: which will prevent the stalks growing so heavy as to be laid by their weight: and it will, also, dispose the plants to *tiller*, and produce more ears.

The *fifth* of the diseases of less consequence, mentioned by the Count, he calls, INFESTAMENTO DEGL' INSETTI: in English, *the being infested with insects*. This does not seem to be so properly a disease, unless where the insects are bred in the plant itself, as an injury from an external cause: though some other disease of the plant may contribute

bute to it. — The Count enumerates various causes of the abounding of insects: but, as they are commonly known, it is needless to repeat them here.—In speaking of the remedies for this evil, the Count specifies several substances and compositions; which, poured or sprinkled on the ground, will destroy, or drive away worms, and other small animals injurious to plants. But this, though practicable in a garden, or for the preservation of more valuable plants, can never be brought into common use for corn, where the large spaces of ground to be so treated would render it far too expensive, and laborious for the farmer. He, also, mentions various fluid compositions and solutions, which are said, if the seed be macerated in them, to prevent the attacks of insects on the plants. But, if some of these preserve the seed itself from being invaded before its vegetation, that is the whole they can effect. For there is not the least shadow of ground to believe, they can give any qualities to the plants, which may protect them from small animals. This is true of such as are intended to destroy, or disgust the insects: but macerations in substances, that conduce to the future vigour and health of the plants, if there be any such, might tend to preserve them from *animalculæ*, that are always apt to abound in weak and diseased plants.—The only practicable general way of destroying or driving off

minute flies, or other small animals which infest growing corn, is by smoke raised from burning vegetables, or sulphureous fossiles mixt with them, when to be obtained, fired to the windward of the places where the small animals abound. This has been found very effectual against the consequences of some blights; and in other cases, where extraordinary appearances of the presence of small animals have been observed,

The *sixth*, and last of the diseases of inferior note, to which growing corn is subject, enumerated by the Count Ginnani, he calls IL PULLULER DEL ERBO ETEREGENE, in English *the multiplication of weeds*. This is, certainly, rather an external accident, injurious to the growth of corn, than a disease of it; and seems, with very little propriety, to bear that appellation. Indeed the Count himself appears sensible of it; and adopts the same only in conformity to former writers. — With respect to the remedy for this evil, he only touches slightly on the means of extirpation of the weeds in the way, they are commonly practised: and which are, perhaps, the only means of freeing the ground from them in general.

I have thus endeavoured, for the use of such as cannot read Italian, or may be deterred by the tediousness of perusing a work rendered voluminous, by being more diffusive than is necessary for practical information, to
give

give the principal and serviceable part of the Count Ginanni's treatise on the diseases of growing corn. If he has not broached many new discoveries in it, he has, at least, made a more ample collection of what was before known, or promulgated, than is to be found elsewhere: and he has arranged his matter in the most methodical and useful disposition. His descriptions of the symptoms and appearances of the several diseases of corn, especially of the four principal, are just, full, and clear: and his distinctions of them are better founded than those of any former writer.—The world is, therefore, highly obliged to him for his labours on this important subject.—The forming systems of knowledge in matters, the improvement of which depends partly on abstracted science, and partly on particular observations and trials, is the only means of a speedy progress of such matters towards perfection.—It is neither necessary for the end, nor, indeed, possible, in the composition of such systems, that they should be complete at their first establishment. But if they contain a copious account of the subject judiciously digested, though in some points defective, or erroneous, they will seldom fail to promote the intended view. For the voids will be afterwards easily filled up, or the mistakes rectified, either by the original author himself, or by others, who may succeed, as opportunity

nity of more extensive or accurate information may present itself. We have a striking instance of this, in the immense additions, and numerous corrections, made by Linnæus to the first fruits of his efforts to form systems of natural history.

In my own treatment of the Count's work, or my collateral disquisition of the several subjects of it, I have endeavoured to do him justice; and yet, at the same time, not spared to comment freely on what he has advanced, where the support or elucidation of any material truth rendered it expedient. As the only laudable end of all writing is to convey just, as well as more extensive notions of the subject, every other motive ought to give way to the promoting that intention: and the Count shews himself too much animated with this sentiment, not to excuse, or even approve of those liberties, which, with all the respect imaginable for him, I have taken in this work.

ARTICLE

ARTICLE XII.

*Account of various Methods of Rearing and Fattening Hogs, verified by Experiments * : communicated by ARTHUR YOUNG, Esq. to the Society for the Encouragement of Arts, Manufactures, and Commerce; and inserted at their Request.*

To Robert Dossie, Esq.

S I R,

I Am directed by the Society for the Encouragement of Arts, Manufactures, and Commerce, to send you Mr. ARTHUR YOUNG's Account of feeding Hogs, in order to be inserted in the Memoirs of Agriculture, &c. if you think proper.

By Order of the Society,

GEORGE BOX, Secretary.

* This account was sent to the Society in claim of the præmium of a gold medal offered, by them, for *the best Account of a Method of Rearing and Fattening Hogs, verified by Experiments* ; and was adjudged to be intitled to it.— A surreptitious copy of the account was inserted in a periodical pamphlet : which was so incorrect as to induce Mr. Young, as he says, to desire to publish immediately a more perfect edition of it himself : for which, on an application, he obtained the consent of the Society. But the difficulty, which attends the circulating little fugitive essays on particular subjects in the country, where principally those of this kind are useful, has disposed the Society to wish, that all the valuable pieces procured by
their

EXPERIMENT I.

THE first week in March, 1765, thirty pigs, just weaned, were drawn from forty-three, that they might be all of a size; they were then distributed into five lots, equally divided; I do not think there was half a crown difference in the value of them; and then fed with distinct sorts of meat. Each five had a sty to themselves, and all were kept clean, and equally littered with straw.

Lot N^o 1. Was fed with pollard mixt with water.

2. With pollard, mixt with skim milk.

3. With boiled turnips, and pollard mixt with the turnip-liquor.

4. With boiled potatoes and water.

5. With skim milk *.

their means for the public, should be transmitted in some larger work, where they may be more extensively spread, and more certainly preserved. In conformity to their request, I have inserted this account here; and hope that reason will be a sufficient apology for so doing, notwithstanding the two former publications of it. R. D.

* Skimmed milk is frequently applied to the feeding and fattening hogs, as well as to the rearing pigs. The pork is sweeter and firmer than the flesh of hogs fattened with any other kind of known food: and it will take salt in the heat of summer. It is practised by some farmers to bring the hogs up with wash and butter-milk, or skimmed milk promiscuously; and then, to fatten them with skimmed milk only: which, they say, gives the greatest firmness to the fat of the bacon.—Mr. Young, in a pre-fatory

They were kept with this food thirty days. I then turned them out of their styes (none had died) and viewed them with a person particularly skilled in hogs; the result was,

fatory remark to these experiments, condemns the application of the milk to this purpose. He says:

“ It is the practice of several countries to use the skimmed milk, butter-milk, and whey in fattening hogs. This is a most pernicious custom: That food for such a use, it is every-where known, has twenty substitutes, viz. peas, beans, buck-wheat, barley, &c. &c. &c.: but it is not so generally known, that pigs may be reared without cows. It is agreed, that the dairy-food is excellent for the latter purpose.” Mr. Young, consequently, directs the view of his experiments, to two ends: the finding other food for fattening hogs; and, by that means, confining the application of the dairy-food to the feeding the pigs after they are weaned, and the suckling sows: and the providing a substitute to milk, even for rearing pigs, where that is wholly wanting, or deficient in quantity: which being obtained, he presumes a greater number of hogs may be profitably brought to the market. In order to this, he says: “ The sows and weaned pigs, should evidently be proportioned, in such a manner, to the number of cows in milk, as to consume all the dairy-food without waste. And other sorts of food provided for the keeping sows that have no pigs.—hogs half,—three-fourths, — full-grown, — and fattening ones.” From the ignorance, or neglect of managing this point rightly, he declares, “ There are many dairies, that do not maintain one tenth of the swine, they might, with proper management.” The observation, that the milk applied to the use of feeding hogs is not confined to the purposes here mentioned, is almost generally true. For it is given, for the most part alone, or with other food, to swine of all ages, or under all circumstances.

R. D.

N° 2. The best, pollard and skim milk.

5. Next best, skim milk.

1. Next,—pollard and water.

3 and 4. Equal.

It appears from hence, that pollard and milk are the best food ; milk alone, very good. The other articles advantageous (for none of the pigs were in bad order) though not equal to the former.

EXPERIMENT II.

At the same time with the preceding trial, four lots of pigs, that had been weaned three months, were equally drawn from my farm-yard, five in each lot. They were confined as before, each lot to a sty, and cleaned at the same time : their food was as follows :

N° 1. Bran mixt with skim milk,

2. Boiled potatoes.

3. Boiled carrots,

4. Raw carrots,

They were kept to this food thirty days ; I then viewed them as before, with the same person.

N° 3. Much the best, boiled carrots.

1. Next, — bran and skim milk.

2. Next, — boiled potatoes.

4. Worst, — raw carrots.

Boiled

Boiled carrots appeared very clearly on this trial to be an admirable food for hogs of this age; *so good*, that I determined to make use of this hint in future. Boiled potatoes appear also a good food*. Raw carrots keep them, I think, better than the farm-yard, but were not equal to the other kinds.

EXPERIMENT III.

January 1, 1766: forty pigs, that had been weaned about a fortnight, were draughted very equally into eight lots, and confined each to a sty; they were cleaned out, and littered always on the same day, equally. Their food was as follows:

N^o 1. Raw carrots.

2. Boiled ditto.

* A large field of experience, elsewhere, has shewn, that potatoes are an excellent and cheap food for hogs; as well for bringing up, as fattening them. In Ireland, particularly, great numbers of swine are reared; and fattened with them: and it is allowed, that the bacon is very good.

The difference betwixt boiled and raw potatoes, in the feeding hogs, has not been hitherto well ascertained. But if it should prove, that there are no material disadvantages attending the omission of the boiling this root, of which, the *new or conglomerate species treated of in a following article*, may be produced at a very small expence, they will appear to be the most cheap and convenient kind of food, as well for rearing as fattening swine hitherto discovered. R. D.

3. Boiled

3. Boiled potatoes.
4. Pollard mixt with skim milk.
5. Ditto mixt with boiled turnips.
6. Malt-dust mixt with skim milk.
7. Skim milk.
8. Ditto, and half carrot-water boiled.

They continued upon this food the month of January, and were then viewed; the result was as follows:

- N^o 4. The best, pollard and milk.
7. Next, — skim milk.
2. Ditto, — boiled carrots.
3. Ditto, — boiled potatoes.
5. Ditto, — pollard and boiled turnips.
8. Ditto, — skim milk and carrot-water.
1. Ditto, — raw carrots.
6. The worst, two dead, malt-dust and skim milk.

Pollard and milk hitherto maintain the superiority; boiled carrots excellent; the rest almost equal, except the malt-dust, which is evidently bad.

EXPERIMENT IV.

In the beginning of June, 1766, I confined sixty hogs, half and three-fourths grown, in my hog-yard (a pond's mouth in it), and fed them fourteen days with clover mown fresh

fresh every day ; it was given in their troughs, with racks across, to prevent their soiling it. They fell off in their looks in about four days, and grew worse and worse, several dying. At the end of that time, I gave them some malt-grains and wash every day, for a few days longer ; but the effect was no better, more dying. They were then all turned into the clover-field, from whence it had been taken, and confined constantly to it for some time. Not one more died, *for they all thrive* greatly *. It will not, perhaps, be impertinent here to add, that I never found any method of using clover more bene-

* The *thriving* here mentioned is confined, in its meaning to the hogs attaining to a good condition to be fattened : but not growing fat, properly for market. For Mr. Young says, in his preface, “ The practice of some counties, as well as the annexed experiments, prove, that clover is a most capital object in *keeping* all these sorts of swine : but those writers, who assert, that it will *completely fatten* them, go much too far.” But the gaining so cheap and easy a way of keeping them till they acquire a proper age to be fattened, as the turning them into a clover-field, and suffering them to remain there till taken out to be fattened, without any further care or trouble, is a matter of the utmost consequence to this branch of husbandry : as he observes thus : “ There is no sort of cattle in a farm, that requires more attention than hogs. Any method, therefore, that simplifies the management must be peculiarly valuable.” The method of rearing hogs, here proposed, has this merit in the highest degree : and the feeding the hogs in winter with raw carrots, or parsnips, or potatoes, is almost equally simple. R. D.

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ficial than thus applying it to the feeding of hogs *.

* Mr. Young, in his prefatory remarks, corroborates what he has here advanced, as to the benefit of feeding hogs on clover; and gives some hints, as to the manner of management of it. He says, "Hogs, that are a quarter (or upwards) grown, may be absolutely confined to a clover-field until it is necessary to sow wheat: nine tenths of Britain will doubt this fact; but I have repeatedly experienced the truth of it. The fences, it is unnecessary to add, must, in this system be incomparably good; — which necessity, I apprehend, is a particular merit in a mode of Husbandry; for a conduct that forces the farmer to have excellent fences, is, so far, of great utility. It is, also, requisite to add, that there must be a pond in the field, which never fails. In a good crop of clover well fenced and watered, swine of this sort may be locked up from the middle of May to Michaelmas; and no consumption of the clover will pay the farmer better: I could add many experiments to prove this assertion; but a certain brevity is requisite in such slight essays as this." In another place, of the prefatory remarks, Mr. Young asserts, he has found "that ninety hogs will, in fattening, yield as much manure as is worth thirty pounds on the spot. — And where straw or stubble are to be had cheap, to a much greater amount."

This account will appear very extraordinary, as to the quantity, and value of the hogs dung produced by the ninety swine while fattening, to all who have not made particular observations on the subject; but especially to those who have retained the former prejudices against the use of hogs dung at all, as a manure. It is but a few years ago, since this prejudice was almost general in the North of England; and I have seen, in Yorkshire, particular caution used, that the cleansings of the pig-stye should not be mixt with the dung-hill for manure; but thrown away as noxious to the land.

E X P E-

EXPERIMENT V.

At the time of the preceding experiment, eight hogs, of equal size, were divided into two lots, and confined to two styes. Four were fed fourteen days on clover mown, and the other four on lucerne mown; they were given at the same time, and in the same styes. At the end of that time they were viewed attentively: both were bad, but the clover ones much the worst, one near dying.

EXPERIMENT VI.

The month of December, 1766, twenty pigs, that had been weaned a month, were draughted into four parcels, and kept that month, separately, in the following manner:

- N^o 1. Boiled carrots.
- 2. Boiled potatoes,
- 3. Boiled turnips.
- 4. Boiled cabbages.

At the end of the month they were turned out, and viewed attentively. The result was,

- N^o 1. The best, boiled carrots.
- 2. Next, — boiled potatoes,
- 3. and 4. equally, all nearly dead.

Carrots continue in every trial superior to all common vegetable food. I am not at all surpris'd at the ill success of turnips and cabbages.

EXPERIMENT VII.

In June, 1767, I draughted from my hogs twenty that were of a perfect equality in size and appearance; they were even half-grown; marked them into four lots, and turned

N^o 1. Into my clover field.

2. ——— lucerne ditto.

3. ——— sainfoine ditto.

4. ——— burnet ditto.

In another month they were drove up and view'd; the result was,

N^o 2. The finest, lucerne.

1. Next, ——— clover.

3. Next, ——— sainfoine.

4. Very indifferent, burnet.

The result of this experiment I think decisive in favour of lucerne, and likewise in the proportionable merit of the other articles. But this must be farther enquired into in future experiments.

EXPE

EXPERIMENT VIII.

In January, 1769, three sows, very much alike in all respects, pigged, one seven pigs, another eight, the third six, in about a week. I ordered them to be fed distinctly.

- N^o 1. With raw carrots.
- 2. With skim milk.
- 3. Common wash of the better sort.

In a fortnight they were viewed. The pigs of

- N^o 2. Were the fattest, skim milk.
- 1. Next, — raw carrots.
- 3. Worst, — common wash.

This experiment is not decisive, for reasons too tedious to mention; but yet the result should urge the attentive to vary these experiments, that certainty may at last be known.

OBSERVATIONS.

The general result of these experiments is drawn into one view in a very few words.

Milk mixt with pollard appears to be, of all food, the most proper for rearing of pigs.

Milk alone is good *.

Boiled carrots, excellent, and fully proved to be sufficient for any farmer to depend on, who does not keep a good dairy.

* That milk alone, or with the addition of some farinaceous food, is good for the rearing pigs, common practice has made evident. The intention of Mr. Young's experiments was to find a substitute for it, where wanting; or that it might be applied solely to this purpose, and not to the keeping sows that have no pigs, feeding hogs after they be full-grown, or fattening swine, when at their proper growth. In the pursuit of this, he had due regard to the two different seasons of the year: as herbage, which is the cheapest food, cannot with certainty be obtained in winter.—We have in the foregoing notes quoted what has been said in recommendation of clover for this purpose, in his prefatory remarks. He adds, in another place, "I have found lucerne to be equal to clover; and, in some years, superior for this purpose.—Sainfoine is, also, of excellent utility; but rye-grass, and burnet, will not, by any means, do.—Natural pastures, with wash, are a good subsistence; but never will be found to equal the artificial grasses." This is the most profitable summer-food: with relation to the winter-diet, he says:

"But in making the greatest advantage of a dairy, we must not confine ourselves to the summer-keeping alone. Provision must be made for winter-feeding such hogs as do not require assistance from the dairy."

The following experiments will prove "that carrots, parsnips, beets, and potatoes, are of admirable use in feeding pigs that have been reared.—They will keep the hogs that have been taken out of the clover in excellent order, and even fatten them, and maintain, to vast advantage, sows that have no pigs."

A stock of these kinds of summer and winter-diet for the hogs, together with the milk of the dairy, make a complete provision for the feeding hogs: and where milk is wanted, boiled carrots, potatoes, or parsnips, may be used as a substitute.

Potatoes

Potatoes are also a very good food*.

Turneps, cabbages, and malt-dust very bad †.

* According to these experiments, common potatoes, though good, are inferior to carrots and parsnips, for the keeping and fattening of swine. But, from the sweetness and solidness of the *new or conglomerated kind*, there is great reason to believe it will be equally nutritive with those roots. This, though not hitherto determined from any accurate experiment, may be further presumed from the great fondness which the hogs shew for this kind of potatoe, even when raw. For they will leave other food when they smell the scent of these roots while growing; break through the fences to come at them; and can scarcely be driven out of the field by any force, till they be glutted with the potatoes. R. D.

† In an experiment, below-mentioned, it appears that on keeping four pigs on raw turneps, for three weeks, three died, and one was near dying.

There are instances, nevertheless, where hogs have been fond of turneps, that have grown on particular land, and thrived with feeding on them: though they have refused those, which grow on other land in the same neighbourhood, and could not be brought to eat them till they were almost starving. The circumstances of soil, and the species of the root, ought to be particularly attended to in experiments of this kind, before general conclusions can be formed. Some slighter trials give room to doubt, whether the new species of turnep, called the *turnep-rooted cabbage*, or *cabbage-turnep*, to distinguish it from the common turnep-cabbage, may not keep hogs. Its weight, solid consistence, and nut-like flavour, favour this notion; and render further experiments worthy pursuit. It is now known, that an acre of this plant will produce upwards of forty tun: and it will bear cultivation on a variety of soils, where carrots and parsnips would fail to yield a moderate crop. The herbage might be used to advantage for cattle and sheep; while the root was reserved for the hogs if it prove a good food for them. R. D.

Of green food, that which is growing, is clearly the best; mown, and given in styes, it is pernicious.

In the field, lucerne is superior to all the rest. Clover comes next, then sainfoine: all these are good. Burnet last, and bad*.

* Mr. Young makes the following observations, in his prefatory remarks, on the whole of these experiments. "By this general system of management, it appears, that hogs are to be maintained the year through upon clover and these roots;—and recourse had to the dairy only for assistance in feeding sows, that have pigs; and rearing their young."

"It must be extremely evident, that, with this conduct, the number of swine maintained on a dairy-farm may be prodigious. — The number of cows point out the number of sows and pigs: and these, again, must proportion the number of acres applied to the production of clover and roots. Thus the whole chain of crops is connected: and each field the support of the other."

"The second object, in the management of swine, is the substituting some food in the room of a dairy, for rearing pigs, upon such farms as keep no cows. This is an object of very great importance: as there are numerous extensive tracts of country, that will produce clover in very great perfection; and, also, many sorts of roots; but where it is either unprofitable to keep cows; or only advantageous to suckle them." "— I found, from repeated trials, that carrots, and parsnips, will wean pigs of a proper age, almost as well as milk;—that is, in such a degree of perfection as to render the keeping a large number of hogs upon that dependence extremely adviseable to any farmer whose business, or situation may prompt him to do it: and other experiments assured me, that sows, with the most numerous litters, may be maintained to great profit in the same manner.—Potatoes, and red beets,

" I,

“ I, likewise, found of very great use for the same purpose.

“ It may not be improper, here, to consider the consequence of enabling the farmer to keep large stocks of swine, by means of roots, so extremely productive, as those, I have mentioned. There are no soils but what, with proper management, will yield some or other of them : and the crops are immense.—The number of swine to be fattened, or fed by an acre of carrots, or potatoes, would surprise those who have never formed any experiments upon the point : and the excellence of the husbandry, in general, should plead powerfully with farmers to adopt it upon this principle. These roots are all fallow crops : that is, they are of the same advantage to the soil, as a year of fallow : — and, if cultivated in the manner they ought to be, much superior to any fallow. For this reason their culture is beneficial to the land ; and a very material method of bringing it into excellent heart. Their application to feeding swine is, alone, sufficient to improve a farm, that is not almost worn out : since it cannot be conducted without raising large quantities of the very best dung.

“ Now the consequences of adopting the culture of vegetables, that clean, and meliorate the soil ; and in their use infinitely enrich it, must be obvious to every reader. It is no exaggeration to assert, that the best soils may be improved, and the poorest converted into good ones by this conduct ;—and, I can assert an experiment cheaper than any other method.—

“ It is from these several considerations, that I apprehend the following experiments may be of real utility to those who have dairies ;—to those, who keep cows, but apply them to suckling ;—to those, who have no cows, but are willing to keep swine ;—and, lastly, to those who, on any soils, are desirous of improving them.”

The plan of improvement here specified is perfectly correspondent with the intention of the Society in their offer of a premium for the best account of a method of rearing and fattening hogs. R. D.

Experiments on Fattening of Hogs.

EXPERIMENT I.

In February, 1765, I weighed a bushel of white boiling pease, the weight was seventy-one pounds, the price 4s. A bushel of pollard, twenty-five pounds one quarter, price 8d. A bushel of bran, fifteen pounds one quarter, price 6d. Quere, which is the cheapest food for hogs, seventy-one pounds at 4s. or twenty-five pounds at 8d? The pease are six times the price of the pollard, and only three times the weight.

THE TRIAL.

I drew four pigs from my herd, of equal appearance, divided them into two lots, and weighed them alive.

	S.	P.
N ^o 1. weighed	6	5
2. ———	6	7
3. ———	6	3
4. ———	6	8

Lot. 1. contained the hogs N^o 1. and 2, weight 12 S. 12 P.

Lot. 2. contained the hogs N^o 3. and 4, weight 12 S. 11.

The

The equality of these weights is remarkable; but in an hundred hogs, I do not think my bailiff would mistake two pounds in half a dozen stone.

Lot 1. was confined to a sty, and had eight bushels of pease given them, weight 565 pounds, price 1 *l.* 12*s.*

Lot 2. was confined to a sty, and had forty-eight bushels of pollard given them, weight 1212 pounds, price 1 *l.* 12*s.* Both the pollard and pease were given dry, with water in a trough. Each lot was weighed, as soon as the food was done. The result was,

	S.	P.		S.	P.
N ^o 1. weighed	19	2			
2. ———	21	5			
Superiority of N ^o 2. is				2	3
Add 1 pound, the first inequality				0	1
				—	—
Total superiority				2	4
				—	—

A single experiment must not be supposed to decide this matter, but future ones may determine it.

EXPERIMENT II.

In January, 1766, I drew from the herd ten hogs, as equal in size as possible, and weighed them alive in five lots.

N^o 1.

		S.	P.
N ^o 1.	weighed	13	4
2.	_____	12	6
3.	_____	13	0
4.	_____	12	11
5.	_____	13	1

A nearer equality than this, in matters that can neither be added to nor diminished, can scarcely be expected.

N^o 1. was fatted with white pease that weighed sixty-six pounds per bushel; the price 30 s. per quarter.

N^o 2. with pollard that weighed twenty-two pounds per bushel; the price 9 d. per bushel.

N^o 3. with buck-wheat, that weighed forty-seven pounds per bushel; the price 2 s. 3 d. per bushel.

N^o 4. with boiled potatoes, that weighed fifty-four pounds per bushel; the price 2 s. per bushel *.

* The new, or conglomerate potatoe, besides its much more nutritive quality, affords more than double the product per acre, of the common potatoe; and, on worse soils, with little manure. So that when it is substituted instead of the common kind, at the price here rated, the comparative expence will be greatly different: and if, as there is great reason to believe, the hogs will grow fat with this kind, though given to them raw, a further saving will be found in the omission of the boiling. Whence the proportion of the expence of the potatoes consumed, compared with that of pease, pollard, buck-wheat, and boiled carrots, would be as 1 l. 4 s. to 3 l. which would unquestionably render this kind

N^o 5. with boiled carrots, that weighed raw fifty-five pounds per bushel; the price 1 s. 1 d. per bushel.

I thought it best to fix on a given sum, as proper to fat each hog. The people I consulted were of opinion, that eight bushels of white pease were necessary to fat one such hog well. This I accordingly fixed on as my criterion. The account of the expence, therefore stood thus :

	<i>l.</i>	<i>s.</i>	<i>d.</i>
N ^o 1. Pease, 16 bushels	3	0	0
2. Pollard, 80 bushels	3	0	0
3. Buck-wheat, 27 bushels	3	0	9
4. Potatoes, 28 bushels	2	16	0
Labour and coals,	0	4	0
	3 0 0		
5. Carrots, 49 bushels,	2	13	2
Labour and coals,	0	6	10
	3 0 0		

Each lot was weighed as soon as the food was done. The result was as follows :

kind of potatoe far the cheapest article hitherto applied to the purpose in question. There is, moreover, ground to conclude the defect of weight, found in the hogs fed with the potatoes, in this account, would not happen were this kind used : as well from the greater fondness the hogs have for it, which would incite them to eat more ; as from its more nutritive quality, apparent from its greater solidity, and much sweeter taste ; which demonstrates it to contain a greater quantity of saccharine juice : the chief alimentary part of vegetables.

N^o 1.

	S.	P.
N ^o 1. weighed	27	6
2. ———	27	9
3. ———	29	13
4. ———	25	7
5. ———	31	0

It is evident from this experiment, that carrots boiled are superior to any of the other food. I did not expect that potatoes would be much inferior; but I have found from divers other trials since, that it is requisite to mix the meal of some kind of corn with them. Pollard in this trial, as in the last, is superior to pease.

In January, &c. 1766, having a large number of hogs fattening, I purchased various kinds of food for them, which were given them, some alone, and others mixt together, to discover which fattened them in the cheapest and quickest manner; this being, in the opinion of some, a fairer way of discovering the nature of every kind of food, than the other method.

EXPERIMENT III.

Seventy-six hogs, from seven to fourteen stone lean, eat in seven days, after nine days fattening,

	l.	s.	d.
17 quarters 5 bushels, pollard	5	17	10
1 quarter, beans	0	4	0
7 quarters 2 bushels, pease, ground	10	17	6
3 quarters 5 bushels, or 2 <i>l.</i> 7 <i>s.</i>	—————		
per diem	16	9	4
	EX-		

EXPERIMENT IV.

Eighty-eight hogs eat in twelve hours,

Q.	B.				l.	s.	d.
1	6	buck-wheat	-	-	1	11	6
0	2	pease-meal	-	-	0	8	0
1	3	bran	-	-	0	5	6
3	3	-	-	-	2	5	0

EXPERIMENT V.

The same hogs eat next day,
2 qrs. of white pease

l.	s.	d.
3	0	0

EXPERIMENT VI.

			l.	s.	d.
The next day,					
1 quarter of pease	-	-	1	10	0
2 bushels of buck-wheat	-	-	0	4	6
			1	14	6

From this day's quantity, I should think they either did not like the buck-wheat so well as the pease, or the buck-wheat is a much more filling food; but two quarters of pease were the greatest quantity of that grain they eat in one day, during the whole fattening.

MEMOIRS OF EXPERIMENT VII.

The next day they eat *l. s. d.*
2 quarters of buck-wheat 1 16 0

This day's fattening is, in some measure, a proof that buck-wheat is an agreeable food to them, since they eat as large a quantity as of pease; but they ought to have as much more of it, if the proportion lies in the weight and price.

EXPERIMENT VIII.

The next day they eat *l. s. d.*
2 quarters and a half of pease-meal, buck-wheat flour, and pollard mixed, the proportion 13s. 4d. per quarter 1 13 4

EXPERIMENT IX.

The next seven days they eat *l. s. d.*
22 quarters and a half of the above mixture, at 13s. 4d. per quarter - - 15 0 0
1 quarter and a half buck-wheat 0 18 0
7 bushels of pease - - 1 7 0
3 quarters and a half is 2l. 9s.
per day 17 5 0

The

The quantity of the hogs eat this mixture, and their thriving extremely well with it, is a strong proof that the different qualities of the several grains being finely incorporated in the mixture of their flour, contributed much to the forwarding of their fattening; and the proportions shew that they eat more than when fed with one only.

EXPERIMENT X.

The next day they eat		<i>l.</i>	<i>s.</i>	<i>d.</i>
1	quarter of buck-wheat -	0	18	0
7	bushels of pease -	1	7	0
		2	5	0

EXPERIMENT XI.

The next day they eat		<i>l.</i>	<i>s.</i>	<i>d.</i>
1	quarter 4 bushels of pease -	2	5	0

EXPERIMENT XII.

The next day they eat		<i>l.</i>	<i>s.</i>	<i>d.</i>
1	quarter 4 bushels of pease -	2	5	0
1	bushel of buck-wheat -	0	2	3
		2	7	3

MEMOIRS OF EXPERIMENT XIII.

The next eighteen days they eat,	l.	s.	d.
24 quarters 1 bushel of pease-meal - - - -	39	0	0
6 quarters of barley-meal - - - -	7	4	0
1 quarter 1 bushel buck-wheat flour - - - -	1	2	6
7 quarters 4 bushel of pollard - - - -	2	5	0
1 quarter of bran - - - -	0	5	4
2 quarters 1 bushel is 2 l. 15 s.			
per day			
	49	16	10

The difference of two quarters and three and a half, in Experiment IX, is remarkable, and seems to prove that the hogs eat by weight and value, and not by measure: the quantities are very different, but the prices do not vary equally. N^o 10, 11, 12, are *whole grain*, at forty-five pounds per day. *This* is all ground, and they eat ten pounds a day more: from which I conclude that the meal fattens much the best.

EXPERIMENT XIV.

The next day they eat,	l.	s.	d.
1 quarter 4 bushels of pease-meal	2	6	6

EXPERIMENT XV.

The next day they eat,	l.	s.	d.
1 quarter 5 bushels of pease-meal	2	10	4

EX-

EXPERIMENT XVI.

The next day they eat, l. s. d.
 1 quarter 7 bushels of pease-
 meal. 2 18 0

EXPERIMENT XVII.

The next three days they eat l. s. d.
 5 quarters 2 bushels of pease-
 meal 8 2 9
 1 quarter 4 bushels is 2l. 14s. 3d. per
 day.

EXPERIMENT XVIII.

The next day they eat, l. s. d.
 1 quarter 4 bushels of pease-
 meal 2 8 0

From all these trials, it appears that the meal is better than the whole grain.

EXPERIMENT XIX.

In January, 1768, I confined three hogs to different styes, and fed them thus,

- N^o 1. with pease.
- 2. ——— beans.
- 3. ——— barley.

to see which pork was best and firmest. They were, in every respect, as equal as possible.

N^o 3. The whitest fat, and firm, and well-tasted meat.

1. The next in whiteness, and equally firm.
2. Very dark and ill-tasted, but firm.

OBSERVATIONS.

It appears from these experiments, that pollard alone (at the preceding prices) is a cheaper food than pease alone.

That boiled carrots is much the most profitable food that has been tried *.

That buck-wheat is a more profitable food than pease.

That several kinds of food mixed, is better than being given alone.

* This must be understood only of the kinds of food above enumerated, as tried in these experiments already specified. For, in the experiments below given, which Mr. Young subjoined in his publication, to those related in his account to the Society, he acknowledges that parsnips were found in one trial superior to carrots. This is by no means extraordinary, if we consider how much more the parsnip appears, by its sweetness, to abound in saccharine juice than the carrot. For the same reason, we may conjecture, the *skirret* to excel both of them for this purpose: and the product of it in some soils is far greater than that of the others. It were, therefore, to be wished, that some comparative trials were made of these three kinds of roots, applied to this purpose. R. D.

That

That the meal of any one, or of various kinds of grain, is better and more profitable than the whole grain, mixed or alone.

That pease and barley are a much sweeter food than beans.

The above experiments are humbly submitted to the Society, not as perfect, but rather as a mark of the Author's wishes to be useful. He shall not be displeased to find that others have been more accurate and attentive than himself *.

ARTHUR YOUNG.

* To the above account delivered to the Society, Mr. Young, in his publication of it, added the following additional experiments.

I.

" In January, 1766, twenty pigs, that had been weaned six weeks, were draughted into four parcels, and kept for three weeks upon the following articles of food :

" N^o 1. Boiled carrots.

" 2. — parsnips.

" 3. — red beets.

" 4. — potatoes.

" They were then viewed, and the result ;

" N^o 1. The best.

" 2. The next best.

" 3. The next ; very near equal to N^o 2.

" 4. The worst, but very good.

" The difference between them but little.

" Carrots, in this trial, appear to be superior to the other articles ;—but not so much as to prove decisive.

II.

" In February, 1766, drew six lots of pigs, four in each ;—the equality very exact ; and, confining them

“ to separate styes, fed them in the following manner
 “ three weeks :

“ N^o 1. Raw carrots.

“ 2. — parsnips.

“ 3. — red beets.

“ N^o 4. Raw potatoes.

“ 5. — Jerusalem artichokes.

“ 6. — Turnips.

“ At the end of that time viewed them ;

“ N^o 1. The best ; in good order.

“ 2. } Next ; equal : these also in good order.
 “ 3. }

“ 4 and 5. The next ; equal.

“ 6. Three dead ; and the other dying.

“ Carrots, parsnips, and beets, are excellent food ; po-
 “ tatoes and artichokes, the same, though in a some-
 “ what inferior degree : turnips wretched.

III.

“ In January, 1767, drew three lots of weaned
 “ pigs, and fed them a fortnight as follows :

“ N^o 1. With boiled carrots.

“ 2. — parsnips.

“ 3. — beets.

“ Viewed them at the end of that time ; the result,

“ N^o 2. The best.

“ 1. The next.

“ 3. The last.

“ But all in good order. Parsnips, being superior
 “ in this trial to carrots, contradicts, so far, the re-
 “ sult of the preceding experiments ; but a few trials
 “ must never be considered as decisive. In all agricul-
 “ tural ones, the general averages are the points alone
 “ which carry conviction.

IV.

IV.

“ The 6th of January, 1767, confined six pigs, two months old, to a sty, and fed them for six weeks with nothing but boiled Jerusalem artichokes, and the common wash that is given to lean hogs, as a trial to discover how far that root may be depended on for feeding such pigs. The result was favourable; at the end of the time they were viewed, and found to be in good order;—not so well-looking, as I have often had such pigs kept on other meat,—but well enough to shew that this food is a matter of much importance.”

The public are greatly obliged to Mr. Young for these ingenious experiments and accurate observations. If, from the want of repetition they are not decisive in every point, yet they afford great lights for the more easily attaining a determination on the important question, how hogs may best and most cheaply be reared and fattened for the market?

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ARTICLE

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ARTICLE XIII.

OBSERVATIONS *on making BREAD: exhibiting the Means of distinguishing good corn;—the Weight of Wheat; and the Proportion afforded by it of fine Flour, Bran, and Bread;—the Composition and subsequent Management of Bread.—Methods of preserving Yeast, and making Leaven to answer the ends of it;—and the Means of procuring good Bread from other cheap Ingredients where Corn is wanting.*

THERE are several of the domestic arts, which, though constantly practised, are yet far from being perfectly understood in general.—Among these we shall scarcely find any, of which this remark holds good more justly, than that of making bread. Simple as the practice of this may seem, it is very frequently ill performed with us, through ignorance, even where no other disadvantages attend: and where the usual ingredients are not to be obtained, or only at a dear rate, a distress of course follows among the more indigent part of the people. Such a share of information, nevertheless, as may be imparted in a small compass, would remove the inconveniencies resulting in either of these cases; and enable those, who have it in their power,

to procure the common ingredients constantly, to make good bread of them ; or those, who have not, to supply their place by substitutes, that will perfectly well answer the end, as to any material points.

In London, nearly the whole of the bread consumed, is had from bakers ; and, in other populous towns, it may be obtained of them by those who cannot make it. The quantity of malt-liquor, brewed in such places, renders it generally practicable to procure yeast : and the rates of labour enables the common people to purchase bread. But, in many country-places, families must supply themselves with the bread they eat ; and, if they are ignorant of the right manner of making it, they must fail of such as is good :—fresh yeast, in some parts of the year is scarcely to be got on any conditions :—and, in cases of great scarcity of corn, the poorer people are not able to purchase a sufficiency for themselves and families. All these inconveniences admit of remedy or prevention by means of due respective knowledge. Bread may be always made good by methods, which are easily practised when understood :—the want of yeast, at particular seasons of the year may be prevented, by knowing how to preserve it, and lay up a stock while it is plentiful ; or to prepare substitutes at all times, that will answer the purpose of it :—and there are other vegetable products, besides corn, from

which the common people, when they are apprized of the manner, may obtain bread equally good, either as to flavour or wholesome nutriment; and which, at the dearest times of corn, may be procured at such small expence as renders the bread made of them much cheaper than that of corn ever can be, even when the price of grain is at the lowest.

As to the introducing new kinds of bread instead of that made of corn, there is, indeed, some difficulty, from the prejudice which the generality of mankind ever entertain in favour of matters to which they are habituated; and this is, perhaps, stronger in our common people than in any other.—The present affluence in our country has introduced very luxurious notions with respect to bread in the lower class; especially in places of trade and manufacture. The poorer sort in London scorn any bread but what is made of the finest wheaten flour. Though the sifting it so fine occasions a great waste of the nutritive part of the grain; and has no advantage, but the supposed elegance of appearance, over the bread made of flour less finely sifted. As is evident from the preference given by many of the superior people to what is called brown bread; which is by them eaten as a dainty. In fact, nevertheless, the whole choice of the kind of bread depends mostly on fancy, and habit. For on
the

the continent some sorts are eaten, and would there be preferred to our finest, which the common people here would sooner starve than touch, even when pinched with hunger. The coarse sour bread, made of rye, called pompanichel, baked in large loaves, and kept several months till it be almost as hard as wood, is eaten, and liked by the boors in a great part of Germany. In the most northern parts of Europe, bread made of the bark of pine and fir-trees, and sometimes of the birch-trees, is the common food of the peasants. It is made of the bark of these trees dried in ovens; ground afterwards to a kind of meal; mixt with a proportion of the meal of some kind of corn, mostly of oats; and then made, with water, into paste, which is suffered to stand a while to leaven, and then formed into loaves and baked. Both these kinds of bread are agreeable to the inhabitants of the places where they are in use: but would be, to the last degree, disgustful here. Our people, likewise, in some parts of Great Britain, where they are accustomed to it, prefer, to the sweetest wheaten-bread, oaten-cakes leavened, and baked on a stone: which begin to acquire a sour flavour in less than four-and-twenty hours; and yet are often kept for a fortnight, or longer.

But, notwithstanding the choice of bread is so much determined by habit and fancy,
yet

yet the people are not to be easily led away from their confirmed likings, even for the alleviating the distress which results from great scarcity. Luxuries, when established, become necessary to the imagination, and the people feel themselves miserable when they find themselves deprived of them. They will submit to very great hardships rather than adopt what is contrary to their reigning taste. The only means, therefore, to prevent the mischiefs, which may arise from the want of any thing in habitual use, is to secure as far as possible the plenty of it; or, when that may fail, to supply some substitute which may differ very little from it.

It is with a view to remove, in all cases, these several above specified causes of procuring such bread as may supply the generality, that these observations are presented to the public. Though they may be needless to many, who have no want of information on these points; yet to those, who have, they may be of great service: and there are few subjects of communication that have not the same limits as to the extensiveness of their utility.—The domestic arts which furnish the necessaries of life ought to be as universally understood to perfection, as practised: and whatever conduces to the general diffusion of knowledge so important has, in a great degree, the same consequence as inventive improvements,

The first step towards the procuring good bread, is the making choice of good corn where it may be had.—In order to this, it is requisite to be able to distinguish the sound and perfect from the bad. In distinguishing good corn by sight, regard must be had to the following signs.—That the grains be plump and hard;—of a like shape to each other;—and free from discoloured spots or a dusky blackness.

The want of hardness and plumpness indicates, that the corn was either not perfectly ripe, or reaped and got in with too much moisture: whence it is either found soft, till dry; or, the size of the grain contracting afterwards, the outward coat or skin appears shriveled. Such corn will not yield a large product of flour: nor will what it does afford be perfectly good, but subject to grow musty and be depraved on keeping. The corn raised in our country is, in wet and cold summers, more liable to this fault than that cultivated in more southern climates. The French know this so well, that when corn is not plentiful with them, they have frequently taken quantities of us for their home-consumption; and sent what they have reaped in their southern provinces to their West-Indian islands, which they supply in part with flour.

The dissimilar or irregular form of the grains of corn, as well as the discoloured spots

spots or specks, manifest some disease; and render the quantities under examination, in which they are found, suspicious, in proportion as such grains abound in them. The particular appearance of each kind of diseased grain has been before specified in Article XI. of this volume; and may be easily learnt there.

The dusky blackness appearing on the outside of the corn, which shews it to be smutted, is the strongest, as well as plainest reason, for rejecting it, where sound corn can be had. But it is requisite, at present, to be further careful in guarding against smutted corn than merely to judge by a slight inspection. For there are various means of art now discovered of freeing it from this exterior blackness, while a great part of the diseased grains yet remain. This blackness results from the kind of smut described, page 171 under the name of *Il carbonne*, or bag-smut. It is, originally, within the coat of the diseased grains: but as they are broken in the threshing, it is diffused over the outside of any of the rest which come in contact with it. At the same time a considerable quantity of the bad grains remain unbroken, and conceal within them a proportion of the like black powder. Various means have been discovered of taking off this exterior powder without the use of water; and rendering the corn clean and good to the eyes,
on

on a general inspection, though all the unbroken smutted grains continue in it. To detect this, when practised with a view of passing such corn for good, it is proper to bruise a small quantity: and the blackness will, of course, shew itself by the bursting of the diseased grain. The corn, may, nevertheless, be freed in a considerable degree, from the smutted grains by the use of strong brine, on treating it as is practised for seed-corn, according to what has been explained in Article XI.: as the grains will be buoyant in the brine; and may be skimmed off while floating on the surface of it. This may be performed without much expence or difficulty, where there is a necessity of making bread of smutted corn. But the corn must not be suffered to remain soaking in the brine, as when it is intended for seed, longer than while the bad grains can be skimmed off: and then it should be immediately taken out; washed well with fresh water; and afterwards kiln-dried. Smutted corn may thus be rendered tolerably good for common use: but the kiln-drying injures the colour so much as to render it exceptionable at the market. There are, nevertheless, cases, in times of great scarcity, where the use of this expedient may be of material convenience to particulars.

The most certain method of distinguishing good corn, is by weight: rejecting, when

there is opportunity of choice, such as is soft, or does not appear perfectly dry.—The mean weight of sound wheat has, by very accurate trials, been found to be nearly sixty-two pounds, market-measure ; or sixty and one half, standard-measure. As sound corn does not, therefore, sometimes weigh so much, no quantity under examination ought to be condemned, if it be not more than three or four pounds defective in the bushel, provided no other signs of faultiness be found in it.—But, in proportion as it exceeds, or falls short of sixty-two pounds per bushel, market-measure, it may be deemed better or worse.—If to the due weight, consequently, plumpness, hardness, regularity of figure in the grains, and a clear equal colour without spots or dusky blackness be added, the corn may certainly be deemed good.

The produce of a bushel of wheat weighing sixty-two pounds, in meal, when it is ground, should be nearly about fifty-nine pounds four *ounces* : and so in proportion, when the original weight is greater or less.—This meal if it be ground with good French stones, and be sifted of a moderate degree of fineness, in the common way, will afford about *forty-five pounds and a half* of FLOUR ; and *twelve pounds and a half* of BRAN. But there are boulting machines, (of which there is a model of one kind, on a very good construction, in the collection of the *Society*
for

for the Encouragement of Arts, Manufactures, and Commerce,) which will separate the flour from the bran without any loss in the operation.—The degree of fineness here stated in the flour is sufficient for making good household white bread. But there is flour finer in several degrees, prepared for the London-market: particularly the kind called the Hertfordshire-whites: which is used either alone, or mixt with the common kind, where it is desired to have the bread very white, without having recourse to condemnable arts. — The proportion of flour, and bran, even in sound corn, ground and sifted exactly in the same manner, will, however, vary considerably. For the difference of the thickness of the coat, or husk, which forms the bran, as well as the tenacity of the inward or farinuous part, will vary, according to the season, soil, and kind of the feed.—The above-stated proportion was, however, found to hold good, on actual trial, in corn weighing sixty-two pounds the market-bushel, and ground with good stones.

With relation to grinding corn, there is one thing very proper to be touched on here. —Great complaints have been frequently made of the adulteration of meal, or flour, when purchased of dealers, or ground at public mills; and, also, of the abuses by bakers; particularly when corn is very dear. There are,

are, likewise, many places in the British dominions, which lie out of the reach of public mills.—It has, therefore, been thought a very desirable matter, in order to avoid all frauds at the mill, and to be certain of having bread free from any mixture with exceptionable ingredients; as well as to be able to grind corn by domestic assistance where there are no public mills; to procure a construction for an effectual mill for grinding corn by hand.—The Society for the Encouragement of Arts, &c. accordingly took up this object some years ago; and offered premiums, as mentioned in the history of their proceedings, given in the *First Volume* of this work, for the invention of a good hand-mill. They had not then the success to bring this matter to perfection; though there were a number of candidates. But, since that time, such improvements have been made on the constructions then produced, as have more nearly completed their views: and there are now two different kinds of hand-mills invented, (of each of which, there is one in the Society's collection of machines) that answer the purpose moderately well.—Both these kinds of mills are formed of steel: experience having shewn, that small stones, such as can be wrought by the hand, cannot be made to act with sufficient power to grind corn with great
fineness

fineness and equality. The one of these is made and sold by Mr. Peter Lyon of Blackman-street, at the price of three guineas; the other by Mr. Freeth of Birmingham, at the price of five guineas. The latter will last with little or no repair for twenty years; and may then, at a small expence, be rendered as good as at first. It grinds a bushel of corn in a short space of time with moderate labour, that may be performed by a strong boy; and the flour is good: not so much greased, as is generally found in other constructions of steel hand-mills.

In the making of bread, even such as may be deemed good, there is, of course, a considerable variation in the method, arising from the custom of different places, the taste of particular persons, and the arts employed by bakers to make the loaves appear large and white at the least expence.—The greediness of grain, has likewise, introduced some practices among bakers, particularly in London, when yeast and flour have been dear, that rendered the bread less sweet and palatable; and, perhaps, less wholesome. But this has been much exaggerated in the accounts given of it by writers.—It is not within the view of these observations, to enter more minutely into a discussion of all the means of adulteration of bread: and I shall, therefore, confine myself to the explanation of the methods of making bread of ingredients that may be deemed genuine.

The method, which is most simple, and approved by experience, for making good white bread for household purposes in the least expensive manner, is as follows:

			lb.	oz.
Take of fine flour	-	-	6	-
_____ water two pints	} in weight		2	8
_____ and a half				
_____ yeast	-	-	-	4
_____ salt	-	-	-	2

Let the water be made warm, but not boiling hot, and then let a part of it be put into a vessel with the yeast; which should be well mixt with it by beating them together with a whisk. Let the salt be put into the other part of the water; and stirred in it till it be dissolved. Afterwards put both the quantities of fluid gradually to the flour; and knead the mass well till the whole be perfectly mixt. Let the dough, thus made, stand for about four or five hours; and then form it into the figure of a loaf: which must be set immediately into the oven, and baked.

In giving the proportion of the ingredients of bread, I have fixed on the quantity of flour which will make the largest loaf, that is convenient for baking: and which is nearly about that of those, which are sold for a shilling in country-markets, when corn is cheap. But where, as is more usual, a greater quantity

quantity of bread is made together, the quantity of the ingredients may be augmented in the same proportion, without the least difficulty in the calculation.

Where yeast is very scarce, a less proportion of it may be used. But a leaven must be then made of it, by mixing it with the whole of the water rendered warm, and as much flour as will bring the mixture to the consistence of a thick syrup: which must stand some hours, fewer or more, according to the defect in the quantity of the yeast. This leaven must then be used in the place of simple yeast, as above directed.—The bread made with such leaven, unless other ingredients be added, is not so good as that made with yeast only. It is less tough when new; loses its sweetness on the keeping; and, in a short time, grows dry and crumbly. It is partly to the use of this method, in a greater degree, that the London-bread has these qualities, and that sourness in the taste; which is frequently ascribed to alum, where none has been used. But the fact is, the bakers make a leaven, as here mentioned, with a sparing proportion of yeast. They mix it about four in the afternoon; and let it stand to ferment till eleven at night. They then form the dough; and let it stand to rise, till the oven be ready for baking it: which is managed to be at four in the morning.

When yeast is used that is not clean, and free from the seeds of hops, or other impurities, it is usually passed through a hair-sieve, after being mixt with the water. But, where the yeast is pure, this practice is a disadvantage: as part of the body of it will remain in the sieve.

One of the greatest difficulties, which is found in making bread, by those who are not accustomed to it, lies in the baking it properly: which does not admit of rules, that can be applied with certainty; but depends mostly on experience. Some hints may, however, assist to the obtaining sooner to a speedy skill in it.—The first point to be observed in baking bread, is to make the oven as hot as may be without danger of burning the crust, or hardening it beyond the proper degree. It may be known when the oven will burn the bread, by the putting into it any vegetable matter: which if turned black, gives an indication that the heat is too great: and the oven should be suffered to cool till it be somewhat under this degree.—The next point is to keep the mouth of the oven well closed till the bread have risen to its full height.—The last is, to determine when the bread is sufficiently baked. It requires some experience of the oven itself to judge of this in practice, by the time of the baking. But those, who are curious, may know it, on particular occasions by the weight of the loaf.
—When

—When the dough, according to the quantity of ingredients above stated, is *eight pounds fourteen ounces*, it should loose when enough baked, about *one pound, two ounces*: which will reduce it to seven pounds twelve ounces. This is a criterion that cannot fail, when the oven is of due heat, to determine when the bread is sufficiently baked. But the taking the loaves out of the oven to weigh them is too troublesome for practice: and the time of their staying there, in proportion to their magnitude, must be the rule to judge by, at least with the aid of occasional inspection.

Where there are no ovens of public bakers within convenient reach, it becomes important to have those which are made for private use, such as may be employed most easily, and with least expence. A portable oven, formed wholly iron, has been invented for this reason by Mr. Clement of Maiden-head-court, Gundock, Wappin, and is sold by him at the price of five guineas. One of these ovens was produced to the Society for the Encouragement of Arts, &c. and is now in their repository of machines and models. On examination of it by proper trials, they gave their approbation, and a bounty to the inventor.—This kind of oven is proposed to have the following advantages: That, admitting of being heated with pit-coal, and even very effectually with cinders or coak, of either of which it consumes only a small quantity, a considerable saving is made in the

expende of fuel: — that it may be quickly brought to a proper heat; which may be easily regulated and continued of the degree required: and that it may be used in any place where there is a common chimney; or where a small vent can be made through the sides or top of the building. — There are many cases, in which the use of such ovens may be very desirable, as well for baking other things, as bread; and it seems to be particularly accommodated to the service of ships.

By a due attention to the particulars above explained, and a little experience in the practice of them, good bread may be always obtained when corn and yeast are to be had. But as there are many cases, where a total want, or a scarcity, may render one or both of them impracticable, or difficult to be procured, it is very material to know the most effectual means of preventing such want; or of providing substitutes that may best supply their place.

In most parts of Great-Britain, difficulties frequently attend the procuring YEAST, even in smaller quantities, at certain seasons of the year, when, nevertheless, at others, that is, during the time of general brewing, it is sufficiently plentiful. *Preserving* it in such a manner, that a stock may be laid up in the time of plenty, against the season wherein it is scarce, becomes thence a matter of great expedience;

ence; and is easily practicable.—The method of doing of this, is, by *drying* the yeast: which will render it capable of being kept for a long space of time without losing its fermentable property.—The drying yeast is performed in the most simple manner: and the only difference in the methods used for that end, consists in the choice of utensils, or vessels, employed for such purpose.—Where only smaller quantities are required, a whisk or rod of twigs is used. This is dipt in the yeast, put in a vessel which is deep in proportion to its contents; and then hung up till it be dry. The same operation is again repeated till the whole of the yeast be taken up; and reduced to a dry mass, adhering to the whisk:—which is then to be kept in this state, in some proper vessel, till it be wanted for use.—Where greater quantities of yeast are required to be preserved, the most convenient method is, to fill a large wooden bowl with it; and to place the bowl so filled in a gentle heat before the fire, till it grow dry. A crust of the yeast will then be formed against the sides of the bowl: and the cavity must be again filled up, and the drying performed as before. The same must be repeated till the bowl be full with the dried yeast: which should be then close covered; and kept from moisture till there be occasion for any part of it.

When the yeast, preserved as above, is wanted for use, some part of it must be cut off the mass on the whisk, or in the bowl; and bruised till it be divided into small parts. Warm water being added to it, in a proper vessel, they must be well beaten together; and suffered to stand two or three hours, when the mixture will gain the appearance and qualities of new yeast; and be fit for all the same purposes.

This method of preserving yeast is very advantageous where inconveniences arise from the scarcity of it at particular times of the year, notwithstanding its being plentiful in the other: and, also, for supplying distant places with it, where it could not, otherwise, be procured at any time, without some troublesome operations, not easily managed.

In places, where no yeast can be commonly obtained for the making bread, a leaven must be used instead of it. There is a necessity for this practice in the colonies, and many other places, where yeast cannot be had at any time, unless procured by extraordinary and troublesome means. Good bread may be, nevertheless, made in such places without yeast: and, indeed, the bread in some of the provinces of France, where it is said to be the most excellent in the world, has no yeast in its composition: but there are other ingredients as well as the leaven added to the flour,

flour, to procure the due lightness, and the other admired qualities.

The leaven proper to be employed, as a substitute for yeast, in making bread, may be prepared and used by the directions in the following recipe: which is according to the method practised in Jamaica, and many other places where yeast is not to be easily procured. It was communicated to the *Society for the Encouragement of Arts, &c.* by a gentleman, who was well acquainted with the practice of it, in consequence of an opinion advanced in the Society, that the rendering the knowledge of an effectual substitute for yeast more general, might be of utility to the public.

“ Procure from any baker a piece of
 “ dough, having yeast in it, such as is made
 “ for bread; and, having let it go through
 “ a state of fermentation, divide it into
 “ pieces, as large as turkeys eggs:—or,
 “ if such dough cannot conveniently be had,
 “ mix some flour and water together, to the
 “ consistence of pap; and set it by in a
 “ warm place. In the course of two or three
 “ days it will ferment: when add as much
 “ flour to it as will make it of the consist-
 “ ence of common soft putty, or dough; and
 “ divide it into pieces as above.—Set these
 “ pieces, either of the baker’s dough, or that
 “ prepared in this manner, in a warm place;
 “ and they will swell, and go through a se-
 “ cond

“ cond fermentation : after which, they will
“ fall and flatten. Let them then be kept
“ dry ; and rather in a moderate warm
“ place : which will harden them ; and
“ preserve them sound, and free from any
“ musty smell. They will not, when thus
“ treated, be unfit for use a month after :
“ although they may be used the day suc-
“ ceeding that, in which they went through
“ the second fermentation. This prepara-
“ tion is then called LEVEN.

“ When bread is to be made, the propor-
“ tion of the leven used must be according to
“ the quantity ; and every other part of the
“ process must be also correspondently regu-
“ lated in the following manner :

“ If sixteen pounds of flour be required to
“ be made into bread, take two of the pieces
“ of leven, which, if dry, must be pounded
“ pretty small ; and mix them thoroughly with
“ about two gallons of luke-warm water.
“ Then add to the mixture four pounds of
“ the flour ; which should be previously
“ passed through a sieve, to free it from
“ lumps ; and let it then be very well mixt,
“ and beaten up with the hand, or a paddle.
“ This mixture, for the reasons hereafter gi-
“ ven, should be of the consistence of pap ;
“ and this regulates the precise quantity of
“ water used. So that, if two gallons be not
“ enough, more should be superadded ; but
“ it must be still warm as the first. This
“ mixture

“ mixture should be performed in a large
 “ pan, pail, or trough, that will contain
 “ at least three times the quantity of the in-
 “ gredients: which should there be placed, if
 “ the season be cold, in a moderately warm
 “ situation.

“ In consequence of this, if the mixture
 “ be not disturbed, in some space of time be-
 “ tween eight or twelve hours, it will fer-
 “ ment to its proper height. This is then
 “ called FERMENT.

“ The great art in making bread this way,
 “ lies, however, in knowing when this fer-
 “ mentation is raised to its full height. For,
 “ by using the ferment at the proper time, the
 “ bread made from it will be rendered light,
 “ spongy, and savoury; but, if it be taken
 “ any considerable time before it arrives to
 “ that height, the bread will be heavy, and
 “ doughy; and if too long after, it will ac-
 “ quire a sourish taste: so that there is requir-
 “ ed some little degree of attention, in this
 “ part of the work, until the person making
 “ the bread gains so much experience, as to
 “ know at sight the due degree of fer-
 “ mentation.

“ This ferment is to be added to the other
 “ twelve pounds of flour, sifted as before:
 “ and the mixture must be kneaded up very
 “ well: in doing which, too much pains
 “ cannot be bestowed. For, according to
 “ the consistence of the dough, thus made,

“ the bread will be more or less spongy.
“ Some people add, at this time, a little com-
“ mon salt to the dough, to render the bread
“ more savoury.

“ N. B. The ferment used should be
“ made with just so much water, as not to
“ require any additional supply, after the
“ flour is added, to bring it to the proper
“ consistence for bread : which should be,
“ that of common soft putty. There-
“ fore, those who are a little used to the
“ process, according to the quantity of
“ bread to be made, will regulate the
“ quantity of water in the ferment. For
“ bread never comes out so light and
“ spongy when plain water is added at
“ this time; however, if any should be
“ wanted, always let it be used warm.

“ The dough prepared, as above, is then
“ to be divided into loaves, without loss of
“ time, according to the pleasure of the per-
“ son making the bread : who must always
“ remember to reserve some little part of
“ it, in the manner first described, to keep
“ for leven, till wanted the next time :
“ which, together with the loaves, should be
“ be put upon a table lightly strewed with
“ flour, to prevent their sticking; and set in
“ a moderate warm place covered from the
“ air, for them to ferment again. When the
“ dough has swelled, and is risen to its full
“ height

“ height, which will be in three or four
 “ hours; it is then to be put into the oven :
 “ and the mouth of the oven should be
 “ closely stopt for two or three hours : in
 “ which time the bread will rise to its full
 “ height. After this, the opening, or shutting
 “ the oven, it is to be regulated according
 “ to the occasion, that the bread may not be
 “ burnt, or become too crusty.

“ N. B. If the mouth of the oven be
 “ not very closely stopt, at the first put-
 “ ting in the bread, it will flatten, and not
 “ be so light, as it would otherwise
 “ be.”

The most important defect of the ingredi-
 ents for making bread arises from the want,
 or scarcity of corn. It not only brings dis-
 tress on the poorer people; but frequently
 riotous irregularities, and disorders, produc-
 tive of great mischief.

In cases of such scarcity, some kinds of esculent,
 or garden, roots may, indeed, generally be ob-
 tained; and would answer the end of bread with
 less expence than that can be purchased for at
 the cheapest times. But, as was before observed,
 the people will never be satisfied by any other
 than their customary mode of diet: and it is,
 therefore, of consequence to shew, how those
 roots may, with the addition of some proportion
 of corn, be formed into bread, which will come
 very

very near in all its qualities to that made wholly of corn.

The root, which will afford the most excellent bread, either for taste or wholesomeness, is the POTATOE. It is happily, at present, the cheapest of those fit for this purpose : and, by further improvements in the culture ; and the introduction of the new, or conglomerate kind, (of which an account is given in a succeeding article) there is great reason to hope it will soon be much cheaper.—The bread made of potatoes, mixed with some proportion of wheaten flour, resembles that wholly made of wheat, so as scarcely to be distinguished by persons not apprised beforehand of the composition. It differs only from the wheaten bread in being somewhat sweeter and moister : which qualities it retains on keeping, so as not to appear so stale, or be near so crumbly after two or three days as the other.—A recipe for bread of this kind was given, in a late number of a periodical work, as translated from a foreign publication ; but there is no reason to conclude, we are obliged to foreigners for the invention of it ; as the preparation of such bread has been well known here a considerable time : and was imparted to me, some years ago, in order to its being made public, by an eminent magistrate in Westminster, who is, on all occasions, zealously attentive to promote the public good. The following method

method has been found to produce this bread in perfection, by the most easy means.

Take any quantity of potatoes; and boil them in water till the skins begin to crack. Then peel them, and bruise the pulp, till no lumps remain in it. To the pulp, thus prepared, put such a quantity of boiling water as may be judged sufficient to make the dough for the quantity of bread intended: and, having mixt it well with the pulp, by stirring them together, add as much wheaten flour as is equal in weight to one half part of the potatoes, with as much yeast, and salt mixt with part of the water as may be requisite, according to the proportion of these ingredients above-mentioned in the directions for making wheaten bread. Then knead the whole well together; adding more warm water, if necessary, to bring it into dough of the common consistence. Let this dough then stand to rise, in a warm place, or, at least, a covered vessel; and afterwards, bake it as other bread, but somewhat more slowly, though to the same degree in the end.

The potatoes are best bruised for this purpose on a table or board, with a wooden roller.—The peeling them, and even the boiling, may be omitted where there is not time or opportunity for it. But the potatoes must then be rasped, or beaten to pulp in a mortar of wood with a pestle of the same.—These variations make little difference

rence in the taste, or essential qualities of the bread.

Where yeast is wanting, a leaven may be made, and employed for this kind of bread in the place of it. This may be prepared, and used in the manner above-directed for wheaten bread, with some of the flour intended to be added to the potatoes: and a small part of the dough may, also, in like manner, be retained for making such leaven on a future occasion: which end it will equally well answer as dough formed wholly of wheaten flour.

Rye or barley flour may, for cheapness, be substituted instead of wheaten, in this kind of bread: which will still approach nearer in its qualities to that made of wheat, than if it was wholly formed of these kinds of grain.

When corn is dear, and potatoes, also, are not to be obtained at a cheap rate, but turneps are at the same time plentiful, the latter may be used in the place of the former: and a very good bread, of a like kind with the above, may, by that means, be obtained.—The turneps, when applied to this purpose, of making bread, are to be pared and boiled till they become sufficiently soft: and the water is then to be pressed out of them.—The pulp thus obtained, is to be treated, in all respects according to the directions above-given for making bread of potatoes.

potatoes. The turnep-bread, thus made, varies in taste from wheaten-bread, rather more than that made of potatoes. But it is only in having a peculiar sweetish flavour; and not that of the raw turnep itself. It keeps better than the bread made wholly of wheat, with respect to the retaining its moisture; and does not contract any bad quality.

In times of great scarcity of corn, and where potatoes and turneps are, also, not to be cheaply had, carrots, parsnips, and Jerusalem artichokes, may be used for the same purpose of making bread, when they are to be obtained at a low price.—They must, in such case, be reduced to the state of pulp, by boiling, rasping, or bruising; and then used in the same manner as has been directed for making the bread of potatoes.—They will not produce bread so like that made wholly of wheat as potatoes or turneps: but it will, nevertheless, be nutritive and wholesome.

By the several means above specified good bread may, in all cases, be obtained, either from corn alone, where it is to be procured in sufficient plenty; or, from esculent roots mixt with some proportion of the meal of corn, in times of scarcity.—Information, regarding any of the respective particulars, may be said not to be generally wanted: but, on those occasions where it may, it is of great private convenience, and, perhaps, public utility, that it should be supplied: as individuals frequently labour under very embarrassing difficulties from the defect of it.

ARTICLE XIV.

Account of the late Introduction of the TRUE or PALMATED RHUBARB, into Great-Britain; with Observations on the proper Method of cultivating, and curing it, in order to obtain the Roots in a State officinally fit for the Purpose of Medicine.

THE importance of RHUBARB, as an article in the *Materia Medica*, is too well known to require any discussion here.—The dearness of this drug, when the best is employed, has, nevertheless, hitherto confined the freer use of it to such persons only, as can afford the expence of costly medicines; and occasioned the necessity of substituting in general for the common people, drugs that are cheaper, though deemed less effectual for the intention.—Considered as an article of commerce, rhubarb being obtained from foreigners, with whom the balance of trade lies against us, the consumption of it is, in that light prejudicial to us.—The very great fluctuation in the price of rhubarb, likewise, merits some regard: for it sometimes rises to a most exorbitant rate, too high to admit of its use, as an alterative medicine, even to persons of middling fortune: and certain possible events might prevent our being able

to procure the best kinds, even at any price.

The above enumerated circumstances render it a desirable matter, that we should, if practicable, produce rhubarb in our dominions, and even in Great-Britain, if possible, in order to make a national saving of what we pay for it to foreigners; to have it in such plenty, as may admit of its being administered as well to the poor as the rich; and to have the certainty of a constant supply of what is good. Perhaps, if circumstances prove favourable, we may in time be able even to export part of our own product, instead of purchasing, as now, what we consume ourselves.

Induced by these considerations, about eight years ago, I prevailed on the Society for the Encouragement of Arts, Manufactures, and Commerce, to empower a proper committee to pursue the requisite measures for introducing the culture of the true rhubarb into Great-Britain; or, if that should be found impracticable, into our American colonies.—The first necessary step to this end was, to ascertain the kind of this plant, which afforded the best sort of rhubarb, commonly known among dealers by the name of *Turky Rhubarb*. This name had been given to it, because it had originally been imported hither from the Levant. But it was afterwards brought, on the extension of

the East-India trade, from China; as, also, in an inferior degree of goodness from Russia: and at last, on the commercial improvements made in the Russian dominions, the best came to us through that channel. Whence it is now called, by some, Russia rhubarb. Along with the disquisition respecting the plant producing the officinal rhubarb, it was, likewise, an object of inquiry, whether we had this kind in our botanical collections of living plants: as there were several there, which different authors, or professed botanists, had asserted to be the true. In order to clear up these points, letters were written not only to several of the most able of our botanists, but to an eminent professor abroad, to request, they would communicate what information, they were able, on this head. The result of the inquiry was concurrent declarations, that a kind, we then had, was the true plant; and though all who had taken up the roots, and dried them, found them shrink, and shrivel without attaining the solid consistence of good rhubarb, or some other of its qualities; yet the reason they assigned for their not acquiring a perfect state for medicinal use, was, according to some, that our climate did not bring them to a due maturity; and, to others, that a sufficient time had not been allowed for their growth, which occasioned them to be too succulent, and to want the ligneous texture of good rhubarb.

In

In consequence of these dubious circumstances, an eminent botanical gardener, to whom the plant, most imagined to be the true kind, had been originally sent from abroad, was desired to raise a proper number of the roots, and keep them till they should attain a greater age, that they might then be dried with care ; and examined, in order to determine the question respecting their being of the genuine kind.—In the mean time, the following incident took place, and anticipated this trial by superseding the necessity of it : as it ascertained the right kind of rhubarb plant ; and put us, at the same time, in full possession of it.

Doctor Moncy, an English physician, then residing in Russia, obtained a quantity of the seed of the best kind of rhubarb plant from the Royal Academy of Sciences at Saint Petersburg ; and sent it to a gentleman in London, who distributed the same among those of his acquaintance, that were curious in such matters. In consequence of this, plants were raised from the seed in various parts of Great-Britain ; but rather as a curiosity than with a view to practical use. Amongst others, Doctor Hope of Aberdeen had one plant, which flowered four years ago ; and induced him to have a copper-plate engraved after it : and some plants were, likewise, raised in the garden of the Musæum in London.

It did not appear, however, from any particulars made known to the public, that further steps had been taken, to render the introduction of this plant into our country of general use and benefit, till about four months ago. At that time, Mr. English of Hampstead informed the *Society for the Encouragement of Arts, Manufactures, and Commerce*, by a letter, that he had raised a number of plants of this kind of rhubarb: some of which were then six years old; that he had taken up some of the roots, dried them, and had trials made of their efficacy; that he had reaped as much seed as would plant a great number of acres; and that finding every appearance favourable to the opinion that good rhubarb could be produced here, he was desirous to have this seed dispersed, through the means of the Society, into the hands of such as might be desirous to propagate this plant, and cultivate it in large, with a view to the obtaining the roots for the purposes of medicine. He sent to the Society, along with this letter, a painting of the plant done after nature, a large intire root in the state it was taken up; and part of another root dried; some of which was whole, and some powdered. — On examination of these specimens, and information of certain relative facts, it was found, that some of this rhubarb having been administered, had operated duly, and kindly, as a purge; and that

that the scent and colour of the powder were similar to those of good Turkey rhubarb. The appearance of the part of the dried root, that was unpowdered, was not equally favourable; but the defect of it was evidently owing to the want of skill in the drying, to which Mr. English was a stranger; and perhaps something was to be allowed to want of age in the plant. As there is good authority for believing that the prime rhubarb is not taken up till it be at least six or seven years old: when its texture is of course more ligneous and solid.

The committee, which was attended by several able botanists, and physicians, on the ground of this examination, came to the following resolutions: which, on being reported, were confirmed by the Society.

“ That it appears to the committee, the
“ rhubarb cultivated by Mr. English is the
“ true *RHEUM PALMATUM*: and that, by
“ experiments made, it is found equal to the
“ rhubarb imported from Russia, in its effects as a purge.

“ That, it is the opinion of the committee
“ if this rhubarb be properly cultivated, and
“ cured in this country, it will be equal to
“ that commonly called *Turkey* rhubarb.

“ That the gold medal of the Society be
“ given to Mr. English for his care in cultivating the rhubarb plant: and for his
“ offer of presenting the Society with a

“ quantity of seed for the use of the public.”

In pursuance of the last resolution, the seed sent by Mr. English to the Society was distributed among a number of gentlemen, who gave in their names, as desirous of the same, in order to its being raised and tried in various soils.

The Society have since come to this further resolution:—“ That the gold medal of
“ the Society be given to Doctor Moncy, for
“ promoting the views of the Society, by as-
“ sisting to introduce the cultivation of the
“ true rhubarb into England.”—They have, also, further resolved to offer a premium for the propagation of the rhubarb plant in Great-Britain on the following conditions :

“ For raising, before the end of the year,
“ 1773, the greatest number of plants, not less
“ than one hundred, of the *Rheum Palma-*
“ *tum*, or true rhubarb, a gold medal.

“ For the second greatest number, not less
“ than fifty plants, a silver medal.

“ Certificates of the number of plants,
“ that they stand at least six feet asunder;
“ and that they have been in a thriving
“ state during the preceding summer; with
“ an account of the soil, culture, and as-
“ pect; to be produced on, or before the
“ second Tuesday in January, 1774.”

The distance required by the Society, for the rhubarb plants to stand from each other, may appear somewhat extraordinary. But they

they established this condition, on having ground to believe, after due deliberation, that, considering the largeness of the tufts, and the great compass the leaves spread, before the roots are of a due age to be taken up, less room would not suffice for the plant to acquire its full state of perfection.

In order to facilitate, and render more effectual the endeavours of the Society, to establish the production of the true rhubarb in this country for use, it may be very proper to give the public the best information, which can be procured, of the natural and commercial history of the plant; and of what other lights may be at present obtained to lead us into a right method of cultivating it here; and curing the roots in such manner, as may make them similar, as well in their appearance, as medicinal qualities to the best Turkey rhubarb.

This kind of rhubarb is called, by Linneus, who is the first that has placed it in any general list of plants, the *RHEUM PALMATUM*: which name he gave it on account of the palmated form of the leaves.

From their total silence about it, we must conclude this plant was unknown to Tournefort, and the other former writers of botanical systems, who appear to have been ignorant of any other kind of rhubarb but those with *dock-leaves*, either of a more round, or longer and pointed form. This
ignorance

ignorance may be well ascribed to the little communication, the western Europeans had, till lately, with the countries where the palmed rhubarb naturally grows; and to the little observation which travellers in general paid to the minuter facts of natural history.

The roots of this rhubarb are large; and branching, near the crown, into very thick ramifications. Their coat is of a brownish yellow colour, before it be dried; and the root itself a darker yellow within. One of those which Mr. English raised and took up, when six years old, weighed fourteen pounds; but it may be presumed that, at a greater age, it would have increased to twenty. They are, when of due age of a woody nature; and when dried of a firm hard substance, the colour of which is a mixture of brown and pale yellow, marbled like a nutmeg.—The leaves are large near the ground, but smaller on the upper part of the stalks. They are divided into several unequal parts, standing separate at some little distance from each other, but uniting in one intire middle part; from which form, seeming to have some resemblance to a hand, this kind of leaf is called *palmed*. They are of a dark green colour; and put out here in March, or the beginning of April.—From the root, arise a number of the main stalks, which branch almost their whole length

length into others smaller. Those of the plants in Mr. English's garden, rose, in the sixth year, to ten or eleven feet height; but at a more advanced age it is probable they will be much higher.—On the branching stalks, grow small white flowers in tufts: which leave seeds like those of the common dock, but bigger.—I shall wave giving here the botanical characters of classification of this plant: as those of the rhubarb are well known to all who are versed in that part of botany: and by such as are not, this kind may be easily distinguished from all other plants by the description of the more obvious appearances here given.

This plant, from its magnitude and height, singular look of its leaves, and numerous tufts of its white flowers, has a very striking and beautiful appearance; and, besides its utility in medicine, is an acquisition to the modern garden as a capital ornament. It is found native in the whole range of the Tartarian countries lying in the degrees of latitude from forty to forty-eight, from the banks of the Volga, and the Caspian sea to China and Corea. The true rhubarb seems, however, much more rare in the western part of this vast track than in the eastern. For though we have had several of the dock-leaved kinds brought to our part of Europe from the countries adjacent to the Volga; yet we never had this
palmated

palmed kind before: notwithstanding the researches made by Tournefort, and many others after the true rhubarb. Nor have the numerous travellers or writers, who have visited or given accounts of the western countries of Tartary, hinted, that they had the least knowledge of a kind of rhubarb with palmed leaves: whereas in the Mungal Tartary, and the eastern countries of the Calmucks, particularly near the banks of the Irtysh, it is so frequent, that it can scarcely escape the notice of a traveller, who is not totally devoid of observation. It is certain, however, on comparison of the roots, of the palmed, when dried, with those of the dock-leaved kinds, that all the rhubarb, which has passed under the name of Turkey rhubarb, was afforded by this plant; though it has been brought to us, at different times, by different routes, according to the revolutions, which have happened in the commerce of the East, and our concerns in it.

In the earlier times, when the whole of our trade with the inland countries of the East was carried on through the Levant, all the good rhubarb, brought to us, came from the ports of Turkey. On the establishing a commerce immediately with the maritime parts of the East, particularly China, and opening a trade with Russia, inferior

ferior kinds of this drug were obtained from those countries; and, in distinction to such inferior kinds, the best was then called Turkey rhubarb. Since that time, on the stop being put, just before the death of the great Czar Peter, to the caravans, which had for some time been permitted to go once in three years from St. Petersburg to Pekin in China, Tobolski, the capital of Siberia, which lay in the mid-way of that route, became a very great emporium or mart to the inland parts of the East. By this revolution in commerce, a considerable quantity of the best rhubarb, as well as that collected by the Mungals, and eastern Calmucks, and sent into China, as that collected by the western Calmucks and sent into Turkey, was carried to Tobolski, and purchased by the Russian merchants; who, conveying it to Petersburg, furnished the opportunity of our being supplied with it thence. It is, however, sufficiently clear from evident facts, that the inferior parcels of rhubarb brought hither from China and Russia, are, in reality, the roots of the palmated kind, as well as the good; but owe their inferiority in quality to their being taken up promiscuously without a proper regard to their age (whence, seven or eight years being required, the greatest part will be too young); or to their not being dried with due skill and care. For, among the parcels of this inferior kind, some pieces

pieces are frequently found, which are perfectly good, and resembling the Turkey: but when the parcels pass the hands of judicious dealers, the more perfect are picked out before they come to us; and sold at different rates from the worse.

It is very remarkable, that the travellers, who have visited and given descriptions of the many countries in the vast tract of Asia, where the true rhubarb may be found, have in general been so silent as to the history of that plant: notwithstanding the importance of its root as a drug, and the singularity of its appearance for magnitude and beauty. Mr. Bell, a Scottish gentleman, who published a narrative of his journey from Saint Petersburg to Pekin with a Russian embassy, has furnished the best, or indeed only authentic, account we have of it. But he has omitted any description of the plant itself, and even the singularity of the form of its leaves. As his veracity, however, can be well depended on, and what he has advanced is mostly what he saw himself, his relation of those particulars, he did observe, may yield some lights for our culture of the plant, in order to obtain it in the most perfect officinal state: and I will, therefore, insert the whole he has said on this subject, as it lies in a small compass.—

The first notice Mr. Bell takes of rhubarb, in the narrative of his journey, is in speaking of the river Irtysh: which has its
source

source from the lake Korzan, in the most inland part of Asia, inhabited by the black Calmucks, where he mentions a very antient building called the *Sedmy Palaty*, or Seven Palaces, yet standing on the banks of this river, in the Calmuck country, considerably below its source. He there says:—"Above
 " the *Sedmy Palaty*, towards the source of
 " the Irtysh, upon the hills and valleys, grows
 " the best rhubarb in the world, without
 " the least culture." This country lies in about forty-three and forty-four degrees of latitude: which is much the same with that of the parts of the Mungal Tartary, where, as we shall see below, the greatest quantity brought now to the European markets is produced. The rhubarb collected on the Irtysh, by the Calmucks, was formerly carried to Astracan; and from thence to the ports of the Levant: whence we had it among other articles of the Turkish trade. But the river Irtysh passing down to Tobolski; and the Russians having forts for a considerable length up its banks, they procure it now by traffic immediately from the Calmucks; as they, also, do considerable quantities, that are collected further eastward from the Mungals.

The next passage, where Mr. Bell mentions rhubarb, is in giving an account of the *Urga*, or camp of the Tush-du chan, or prince of the Mungal Tartars. He says there:—"What they call the *Urga* is the court,
 " or

“ or the place where the prince and high
“ priest reside, who are always encamped
“ at no great distance from one another.
“ They have several thousand tents about
“ them, which are removed from time to
“ time. The Urga is much frequented by
“ merchants from China, Russia, and other
“ places; and all trade is there carried on
“ by barter, without money of any kind.
“ The Chinese bring hither ingots of gold,
“ damasks, and other silk and cotton stuffs,
“ and some porcelain, which is generally of
“ an inferior quality, and proper for such a
“ market. The Russian commodities are
“ chiefly furs of all sorts. RHUBARB is
“ the principal article, which is changed for
“ these goods; great quantities whereof are
“ produced in that country without any
“ culture. The Mungals gather, and dry it
“ in Autumn; and bring it to this market:
“ where it is bought up at any rate, both
“ by the Russians, and Chinese merchants.”
It is owing to the opening this immediate
communication with the Mungala, as well
as the trade with the Calmucks, above-
mentioned by the river Irtysh, that the
Russians have had the opportunity of pro-
curing, at very low rates, the greatest part
of the best rhubarb: of which, however,
such advantages are taken by engrossing
dealers, that it bears now, with us, near as
high a price as formerly, when that collected
by

by the black Calmucks, which was nearly the whole that came to us, was brought by the way of the Levant.

Mr. Bell, in his progress of the narrative of his journey, has this further passage: in which he more explicitly relates all he observed with regard to the rhubarb. What he mentions, passed in the part of the Mungal Tartary, that is under the dominion of the emperor of China, after he had travelled four days journey from the river Saratzin, which he makes the boundary, in that part, between the Russian and Chinese territories."

" In the evening, I walked from our tents, with some of our company, to the top of a neighbouring hill, where I found many plants of excellent rhubarb; and, by the help of a stick, dug up as much of it as I wanted.

" On these hills, are a great number of animals, called *marmots*, of a brownish colour: having feet like a badger; and being nearly of the same size. They make deep holes on the declivities of the hills: and it is said, that, in winter, they continue in these holes for a certain time even without food. At this season, however, they sit or lye near their burrows, keeping a strict watch; and, at the approach of danger, rear themselves upon their hind feet, giving a loud whistle like a man to call in their stragglers; and then drop into their holes in a moment.

“ I should not have mentioned an animal
“ so well known as the marmot, had it not
“ been on account of the rhubarb. Where-
“ ever you see ten or twenty plants growing,
“ you are sure of finding several burrows
“ under the shades of their broad-spreading
“ leaves. Perhaps they may sometimes eat
“ the leaves, or roots of this plant. How-
“ ever, it is probable the manure, they leave
“ about the roots, contributes not a little to
“ its increase : and their casting up the earth
“ makes it shoot out young buds and mul-
“ tiply. This plant does not run and spread
“ itself like docks, and others of the same
“ species ; but grows in tufts at uncertain
“ distances : as if the seeds had been drop-
“ ped with design. It appears, that the
“ Mungals never accounted it worth culti-
“ vating ; but that the world is obliged to
“ the marmots for the quantities scattered
“ at random in many parts of the country.
“ For whatever part of the seed happens to
“ be blown among the grass, can very sel-
“ dom reach the ground ; but must wither
“ and die : whereas, should it fall among
“ the loose earth, thrown up by the mar-
“ mots, it immediately takes root, and pro-
“ duces a new plant.

“ After digging, and gathering the rhu-
“ barb, the Mungals cut the large roots in-
“ to small pieces, in order to make them
“ dry more readily. In the middle of every
“ piece,

“ piece, they scoop a hole, through which a
 “ cord is drawn, in order to suspend them
 “ in any convenient place. They hang
 “ them, for the most part, about their tents;
 “ and sometimes on the horns of their sheep.
 “ This is a most pernicious custom, as it de-
 “ stroys some of the best part of the root.
 “ For all about the hole is rotten, and use-
 “ less. Whereas, were people rightly in-
 “ formed how to dig up, and dry this plant,
 “ there would not be one pound of refuse
 “ in a hundred: which would save a great
 “ deal of trouble, and expence, that much
 “ diminish the profits on this commodity.
 “ At present, the dealers in this article, think
 “ these improvements not worthy their at-
 “ tention: as their gains are more consider-
 “ able on this than on any other branch of
 “ trade. Perhaps the government may here-
 “ after think it proper to make some regu-
 “ lations, with regard to this matter.

“ I have been more particular in describing
 “ the growth and management of the rhu-
 “ barb: because I never met with an au-
 “ thor, or person who even gives a sa-
 “ tisfactory account where or how it grows.”
 “ I am persuaded, that, in such a climate
 “ as this, it might easily be so cultivated
 “ as to produce any quantity that could be
 “ wanted.”

The particular place where Mr. Bell made
 these observations on the growing rhubarb,

in his journey to Peking, was that where the ambassador's train stopped to repose for the night, in the Mungal Tartary, the day after having crossed the river Karu ; and lies betwixt the forty-seventh and forty-eighth degrees of north latitude.—The soil of the country is there very rich, according to the account he has given of it, in several preceding passages : and, indeed, it may be certainly inferred to be so, from the great rankness of the grass, which he here mentions. It may be, also, concluded to be a light loam, from Mr. Bell's having been able to dig up the good part of the rhubarb roots, with the assistance of a stick only : though near the crown, they dip almost perpendicularly into the ground. It would not have been practicable by such means to loosen the earth round them, had the soil been clayey and strong : as it would have been impossible, at least, without great and tedious labour to have penetrated with a stick so deeply, and widely into such ground, that had never been broken up before.—Mr. Bell supposed the holes in the rhubarb, made by those who collect it, are only intended to render the hanging it up to dry more convenient. But there is another reason for that practice : which is, that by scooping out the middle part, the rest grows dry much more quickly : and by that means an opportunity of disposing of it sooner at market is obtained. It is, however, a faulty method :

method : as the cutting the roots into thinner slices would answer the same purpose.

The last remark Mr. Bell has given concerning rhubarb, in his relation of this journey, is an observation, which he made after travelling six days in the Mungal Tartary from the place last mentioned. When, having crossed the river Tola, he says, “ The appearance of the country was now greatly altered for the worse. We saw no more pleasant hills; and woods; neither could I find a single plant of rhubarb. The soil was dry and barren : and the grass not to be compared to what we had already passed over.” This fact is a confirmation, that the rhubarb does not naturally grow, but on a rich and fertile soil. For on the banks of the Irtysh, in the Calmuck Tartary, it is found in the greatest state of perfection, as above-mentioned, in places more to the south than this : and it can be therefore, only owing to the difference of the soil, that no roots of this plant are found here, as well as in all the fertile parts of the countries, which surround this to the north and west.

Having thus shewn in what manner, the rhubarb brought to us is produced in the countries where it naturally grows, I shall now endeavour to point out the methods, which seem most proper to be pursued, in the cultivation and curing it in our own

country, in order to the supplying ourselves with what we may have occasion for.—The reasons, from whence I conclude, the particular directions, that will be given, to be right, are deduced from the facts, related, as above, to have been observed by Mr. Bell; from circumstances, which have occurred in the promising attempt made by Mr. English to bring the plant to perfection here; and from the practice, which experience has evinced to be good in similar cases. — There is, however, some difference to be attended to, betwixt what is proper to be done in the *garden-culture* of the rhubarb, when, as is the case at present with most persons, only a sparing quantity of seed is to be obtained, and the propagation rather than the planting, with a view to great quantities, is the temporary object; and in the *field-culture*, when, as may be the case hereafter, the raising large quantities with a view to the sale of the roots may come in question.—I shall, therefore, first enumerate those particulars, which respect the garden-culture; and, afterwards, proceed to those of the field-culture.

In order to the most certain success, the seeds are best sown on a gentle hot-bed prepared in the common manner: as was practised by Mr. English. But there is no occasion to make a hot-bed on purpose, where
any

any may remain unbroken up, that has been employed the year before, for raising melons, or cucumbers, or for such-like purposes.—The time of sowing, in this case, may be, as most convenient, from the middle of February to the middle of March. But if the seed be sown so early, that the plants rise before the frosts are over, it would be a prudent caution to cover them, during that time, at nights. In other respects, it is more safe to raise them early than later: as they will of course be stronger, and more able to resist severe weather in the succeeding winter.—The seed may either be sprinkled over the beds; and the earth raked over it: or, where there is but a few, they may be set separately with a small dibber at about four inches distance from each other; and at the depth of about three quarters of an inch.—The use of a hot-bed is only to ensure the greater certainty of success: because the plants being forwarder, and having sent their roots deeper into the ground before the succeeding winter, they will be better able to resist any extraordinary inclemency of season that may come on them. But where there is no convenient means of employing a hot-bed, the seed may be sown towards the end of March in the same manner, on any bed of light earth well-sheltered from the north by a wall, or skreen. For there is no danger of their miscarrying, if no uncom-

mon severity of season happen the ensuing winter.

When the plants are come up, they should be kept clear from weeds, and watered sparingly, if the season prove very dry, and they seem to droop from the want of moisture.—Where the seeds are set with a dibber, at the distance above-directed, the plants may be suffered to remain in this state till the next spring: but where the seed is sown by sprinkling, as many of the plants should be carefully drawn out at Midsummer, as will leave these which remain the space above prescribed. Those, which are thus drawn out, should be planted on another bed at the same distances; and shaded till it appears, by their leaves ceasing to droop, that they have taken root. It is most safe to transplant these seedlings into an old hot-bed: but where that is wanting, a bed of rich light earth, sheltered as above, will answer the end with moderate security.

In the beginning of March, the year after the sowing, all these plants will be of due strength to be finally transplanted into the places, where they are to remain to the time of their full growth.—This transplantation may be made either into proper parts of a garden, or any piece of ground set a-part for them. But where the roots are intended for medicinal use, the place should be airy; free from much wet; and having a southern aspect, if there be any declivity in the ground.

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The rhubarb may be propagated by off-sets, as well as seed : the plants sending them out pretty freely. At the time of the final transplantation of the seedlings, they will afford some : which may be taken off with due care ; and replanted on the bed whence the seedlings were taken : where, if they remain till the next spring, they will be fit to be planted out in the places where they are intended to grow.—The same may be done every succeeding year with the older rhubarb plants ; and a great increase made without sowing any seed. The off-sets of plants more than one year old will, moreover, be strong enough to be planted where they are to remain, without the trouble of putting them in a nursery-bed.—It must be observed, however, as a caution, not to tear too much, or injure the crown of the principal plant in separating the off-sets. Nor should the older plants be too much deprived of shoots : which would impoverish the roots ; as the forming the resinous juices, in which their medicinal virtue consists, depends on a due proportion of the herbage.

After the final transplantation of the rhubarb plants, nothing more remains to be done, in the garden-culture, than the keeping them free from weeds : except that where the roots are intended for use, it would be well, for the first two or three years, to loosen the earth in the spring near them,

them, for eight or ten inches, taking care not to wound them. But though it will promote their growth, it is not absolutely necessary.

In the cultivation of rhubarb in larger quantities for sale; or what may be called the *field-culture*; the first objects of attention are, the choice of the ground; the preparation of it for receiving the plants; and the procuring a due number of seedlings, or off-sets.

The soil, on which rhubarb is cultivated, should be rich, deep, and of a light loamy texture. The richness, moreover, should be rather owing to the natural fertility of the earth than to manure. At least, if ground on which manure has been copiously put be chosen, it should be such only on which the manure has been so long laid as to admit of its being well mellowed and putrified.—As the rhubarb does not require great moisture, but, on the contrary, suffers from it, a moderate rising or declivity of the ground does not render it unfit for the purpose. But, in such case, care should be taken, that the aspect be to the south: as that is absolutely requisite to the perfection of the rhubarb in this climate.

The preparation of the ground consists in its being deeply stirred, and well broken.—At present, where very large spaces are not to be cultivated, the earth may be dug up and broken with a spade: and afterwards
raked

raked and laid clean. But labour should not be spared with regard to the depth. Where there is little or no declivity on the ground, it must be laid in pretty high ridges or beds, sloping both ways from the middle, with proper trenches or furrows betwixt them to carry off the water.—If large quantities of ground should hereafter be cultivated with the rhubarb plant, the preparation of it may be performed with the plow and other instruments of husbandry. In this case, the land should be plowed eighteen or twenty inches; which may be done by two or more plowings, in the way practised for that called trench-plowing; except that the lowermost part of the earth need not be turned uppermost as is there done, when it is performed for the improvement of the soil. The upper part of the ground should be well broken, and laid even, by subsequent superficial plowings and harrowings: and care should be taken as above-mentioned to form such six-feet ridges, with intervening furrows, as will sufficiently prevent any stagnation of water from great rains. For it is necessary to take all precautions, that the growing rhubarb may not at any time lye under water, or be subject to much wet.

It is, in the mean time, proper a number of plants must be procured, ready to set out, as soon as the land is prepared. These plants may be raised by sowing the seed, towards
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the end of March in the preceding year, on a bed of good light earth, sheltered from north winds; and treating the seedling plants after they come up in the manner above directed. These seedlings may be transplanted into the full ground about the end of March, or beginning of April: and one row of them should be set on every ridge at the distance of six feet from each other. If the ground should be very dry, which, however scarcely happens at this season of the year, it would be proper to defer the transplanting till rain has fallen, even if it should be considerably later.

At present the method of raising the rhubarb plants from seed is in general necessary: as very few persons are possessed of old roots whence off-sets may be obtained. But, hereafter, when there shall be a sufficient stock of roots of a due age to afford them, off-sets may be employed instead of the seedling plants: which will save the trouble of raising them; and prevent the necessity of waiting a year till they be fit to plant out in the places intended for their growth.—The off-sets taken from the rhubarb plants, that are of more than one year's growth, may be immediately set into the rows, where they are intended to stand for use, without their being first put into a nursery-bed to gain strength.—They should, however, be taken off with the cautions above-

above-mentioned, not to injure the original plant, nor to rob the roots too much of the herbage when they are coming to maturity.

—It is proper, nevertheless, whenever the plants are set into the rows, to reserve some in a nursery-bed, in order to replace such as may be found to have failed in the rows: as their place should be supplied with plants of an equal age with the rest, that all the roots may be fit to be taken up at the same time.

After the rhubarb plants are thus set in rows on the ridges, they should be diligently kept free from weeds while they are young.

—This should be done the first year, by the hand only to a small distance round the plants: but the rest of the quantity of ground may be hoed: or where the ground is large, the horse-hoe may be used in the intervals; and the hand-hoe only employed in the spaces betwixt the plants in the rows. The stirring the ground with the horse-hoe, which may be done pretty near the plants after the first year, will be very beneficial to their growth: and this may be practised as often as the fresh sprouting of the weeds makes it needful, for three years after the first planting. At that time, the rhubarb plants will have gained sufficient strength to overpower any common weeds, that can rise in ground, which has been kept well free from them for the three or four preceding years.

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—This is all the culture, that is requisite from the time of setting the rhubarb plants till the roots attain a proper age to be taken up for use. For, if the plants once take root, there is little danger of them, if they be prevented for the first year or two, from being choaked with weeds : and though this kind of rhubarb does not grow naturally, but in a climate some degrees more southern than ours, yet experience has shewn us, that it is hardy enough to bear the rigour of very severe winters even in the south of Scotland. Indeed, we might conclude, it is capable of resisting strong frosts from the woody texture of the roots ; as well as the resinous nature of the juices of them, and the depth with which they penetrate into the ground.

The most proper time for taking up the roots of the true rhubarb for medicinal use is, when they are of the growth of seven years. In the case of roots that are produced from seed, this period must be reckoned from the time of the plant's first coming up. But when they are produced from strong off-sets, taken from plants of more than one year's age, a year must be allowed on that account : and six years from the planting must be considered as along with that year making up the seventh.—The rhubarb will attain its perfection in seven years growth : but the roots will increase in the eighth year, or longer, without any injury to their qualities.

The season most proper for taking up the roots of rhubarb is, the latter end of autumn, when the leaves are decayed ; and the plant is in the weakest state of vegetation. But, if the weather or other circumstances, do not admit of the opportunity of doing it conveniently so soon, it may be performed any time before the end of December.

The rhubarb roots, where the quantity of ground on which they grow is not very extensive, may be taken up by the common means of digging. But where there is a great space of ground in question, it may be expedient to gain, for the saving time and expence, some assistance from the plow in performing that work. In such case, the earth should be thrown off from the sides of the roots, by plowing two trenches as near them as is practicable without danger of damaging them ; and laying the whole of the earth on the outer sides : the rest must be performed by the spade afterwards.—When the rhubarb roots are taken out of the ground, they should be well cleansed by washing them in water, and then dried by wiping with a cloth ; or, where there are large quantities, by spreading them on any clean place where the air has access to dry them. There is a machine, which consists of a kind of a hurdles, framed together, very proper for this purpose. It was invented for the drying madder ; but may be very ad-

advantageously used in the case of large quantities of rhubarb roots. A model of it is now in the repository of the Society for the Encouragement of Arts, &c.—After the roots are thus cleansed, and rendered dry as to the water used in the washing them, they should be put together in any airy place for some days, that the resinous juices may fix or concrete. After this the larger ramifications or branches of the roots must be separated from each other: and all the fibres and very small branches cut off from them, as refuse parts. The several branches should then be divided into slices, or other pieces, according to their various thickness. The parts of the root, that are of three inches diameter, may be cut into slices of two inches thickness: those of two inches diameter may be cut into pieces of three inches length: and the same proportion may be observed in the parts which are of other dimensions. Where the joining of branches with each other causes knots, those parts should be left in the form, they acquire by the separation of the respective branches from them, notwithstanding they may not be of the proportion here directed. But where such parts are large, they should be reduced by taking off as much as can be without cutting into the knots. This division of the roots into slices or pieces, should be performed with a strong sharp knife. This
knife,

knife for the greater dispatch, where there are large quantities, may have its point fixed to a block, by a small ring: in consequence of which, if the blade and handle be made long, and of due strength, great power, and facility in doing this work will be gained.

When the rhubarb is thus cut into slices, or pieces, each of them must have a hole bored in it towards the edge; and be then strung with a piece of strong thread, or of pack-thread; which must be formed into a loop. By these loops, the rhubarb should be hung on long sticks, or slips of board fixt in an horizontal position; and furnished with small nails, or tenter-hooks, at about four inches distance from each other. There may be as many ranges of these sticks or slips of boards, fixt at about five inches distance above each other, as the height of the building will admit of: and as many rows of these ranges as the breadth of the building will give room for, allowing an interval of about a foot and a half between each. The sticks or slips of board, may be suspended by cords from the cieling; or supported by proper frames fastened to the sides of the building, or resting on the ground; as may be most convenient.—The place, in which the rhubarb is to be thus hung to dry, should be well secured from rain, and other mois-

ture : but it should have such vents or openings on the sides, as may give free passage to the air, and even to the wind, where practicable, that the roots may grow the sooner, and more perfectly dry. — In this state, the rhubarb may remain without any further treatment, till it be sufficiently dry for use.

The appearances, by which the rhubarb may be known to have a due degree of dryness, are, the ceasing any longer to diminish perceptibly in size :—the having acquired a variegation of colour on the surface of the part cut ; being an intermixture of brown and lightish yellow, marbled in the manner of a nutmeg : — and the having gained a hardish firm consistence.—It is impracticable, nevertheless, to note or describe by words, the proper degree of these appearances in such manner, that a person not previously acquainted with it, by frequent inspection of good rhubarb, may become thence capable of judging when it is perfectly attained by any parcel set to dry. Whence the most expedient method, for those possessed of a considerable quantity of the roots in that state, to whom such previous knowledge is wanting, is to procure a piece of the best rhubarb ; and to form a judgment by comparing it with their own : which will enable them to determine with precision.

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When the rhubarb is found to be sufficiently dry, it should be well wiped from all dust and foulness. The prime parts, which resemble the best Turkey rhubarb, should be then picked out from the others: and if any of the surface, where the division has been made, appear to be too light in its hue, and to want the marbled mixture of colours, such surface may be pared with a very sharp knife: which will revive the colour, and enhance the marketable value. The pieces next in goodness may, likewise, be selected from the worst; and will make a second sort of good rhubarb. The other, or worst part, may be reserved to be disposed of as an inferior kind; but will yet be saleable at a lower price, for making tinctures, &c.: for which purposes, it will very well serve.

The whole of all these sorts of rhubarb should, when they have been separated, as here directed, be put into boxes, lined with paper, and well secured from air or dust: and they may be thus kept, in a dry place, till wanted for sale or use.

ARTICLE XV.

An Account of the Qualities, Culture, and Use of a very valuable Species of POTATOE, lately brought into Cultivation in England.

THE kind of potatoe, of which the following Account is given, has hitherto no established name. But it is necessary, in order to distinguish it from the common kinds, in treating of its difference from them, that it should have some peculiar denomination.—If we were to speak of it, as an object of natural history, and to borrow a name of distinction from its sensible qualities, it might be most properly called the CONGLOMERATED POTATOE, from the almost constant appearance, that each potatoe of this kind consists of a number of lesser tubers, or potatoes grown together; or is, as it were, a cluster of several united with each other.—But it is more suitable to the style of husbandry, to give this potatoe a familiar name, taken, as is usual, from the place where it first began to be largely cultivated, or much known: and, on that principle, we may properly call it the BEDFORDSHIRE POTATOE: which name I shall, therefore, adopt in speaking of it here.

The great utility of the common potatoe,

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as an article of human food, has now been a number of years well known with us : though the actual use of it has not prevailed among the poorer people, in many parts of England by far so much as might have been expected, or wished. The cheapness of this root, compared with other esculent vegetables, particularly recommended it much earlier to the Irish, at a time, when a great part of the lower people of that country were in a state of poverty, from the want of tillage, manufactures, and trade : and their remarkable health and strength when almost solely fed with it, evince its wholesomeness and nutritive properties : while the preferable fondness to every other kind of food without the least satiety, which these people almost universally have for it, shews it to be naturally as agreeable to the human appetite, as to the constitution.—The use of the common potatoe, as an article of agriculture for the feeding cattle and hogs, is of much later introduction with us : and, indeed, has yet made but little progress. The Irish have applied this root for a considerable time very largely to the feeding hogs and poultry ; but hitherto not at all, or in a very confined manner, to the feeding of cattle.—The reason, why we have been prevented from earlier enjoying these advantages, lies obviously in the price of labour, and land in England : which hindered us from obtaining

this root at a sufficiently cheap rate, till by the substituting the use of the plow for that of the spade, both in the planting and taking up, we made such improvements as to saving of expence in the cultivation, that we have been enabled even to send large quantities from our north-western counties to Ireland: and that, even in the out-parts of London, it has been found profitable to rear neat cattle with this root.——The more extensive cultivation of potatoes with a view to the rearing and fattening cattle as well as for the food of the poorer sort of people, must, therefore, produce great benefit to the public: since the crops of this root prove frequently the best in those seasons, when, through too much wet weather, the corn fails, and the hay is spoilt. Whence a security is afforded against an absolute want of food for the poor; and against that scarcity of winter, and spring food for cattle, which is a principal cause of the incidental dearth of provisions with us. — The application of the potatoe to the rearing cattle will, moreover, when it can be done with profit, be in some manner a substitute for the pasture of the commons now inclosed: the loss of which, according to the apprehensions of many, tends to occasion a great decrease in the number of cattle reared: as the saving, that accrued to farmers and cottagers, from the enjoyment of the common-right, in
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the expence of bringing up cattle, was the principal means of their gaining by them ; or frequently of their being able to keep them at all.

With respect to the feeding hogs with potatoes, it is not yet demonstratively determined, whether, in our country, the common potatoe, parsnips, or carrots, be the cheaper food under the present circumstances. But as the potatoe may often be raised on land, where the others will not afford copious crops, as they require great depth and lightness, as well as richness of soil, it must at least be allowed a local preference for this use.

Though the improvements, in the culture of the common potatoe, have already advanced its utility so far, with relation to the purposes of agriculture ; yet there seems somewhat more wanting, in order to its being very generally suitable to the farmer for feeding cattle and hogs. The copious product in a successful crop makes it answer, in the end, to those who can afford to be at the necessary expence : but requiring a considerable share of labour and manure, as well as good land, the raising potatoes in great quantities is not a compassable matter to many, who might, otherwise, consume them advantageously.—To remove this obstruction to the more general use of potatoes for the feeding cattle and hogs, what seems

further wanting is, the means of raising on inferior land, and with less manure and labour, crops equal to those now obtained; or much larger crops on good land with the full quantity of manure: which would lessen the proportion of the expence of the culture to the product. — Being provided with these means, the less able farmer, might, according as either of these advantages should suit his particular situation and circumstances, be able to undertake the culture of potatoes without more difficulty than would attend any other crops; as his disbursements would be diminished; and his limitation as to the quality of land or quantity of manure and work removed. — These requisites to the cheap, easy, and consequently general culture of potatoes, seem to be attained by the acquisition of this new kind of them, which, for the reason above-mentioned, I shall call the BEDFORDSHIRE POTATOE, and of which, the importance appearing in this light, so striking, must render an account of its introduction, qualities, and best mode of culture, acceptable to all engaged in pursuit of the improvements of agriculture.

Applications were made to the Society for the Encouragement of Arts, Manufactures, and Commerce, with respect to the Bedfordshire potatoe nearly at the same time, from two different quarters; and they took their rise from the following circumstances.

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A gentleman of fortune in Northumberland found a new kind of potatoe was cultivated among his tenants ; and that it was much preferred by them to the common kinds. He inquired whence they had obtained it, but could receive no certain satisfaction as to that point : only some of the people declared it to be their opinion, the first of these potatoes had been found on the sea-shore, in consequence of their being thrown or washed, out of some ship, that had been wrecked on the coast, which brought them from some foreign country. It appeared to this gentleman, on further examination, that this kind of potatoe had extraordinary qualities, and were different from the common, particularly with respect to the prolific disposition of the roots : which he conceived might possibly render a further knowledge of them of importance to the public. In consequence of this, he brought a few of the potatoes to London ; and some of them were planted in the Duke of Northumberland's garden at Sion. Cuttings of them were set in ridges ; but at considerable distances. When they were taken up, it was found that the single potatoes exceeded the common kinds greatly in magnitude ; and that the product of the whole was, also, much larger. Some of them weighed four or five pounds ; but they had the appearance of being a *congeries* or cluster of a number

ber together, rather than one distinct tuber or potatoe. The colour of the inside of them was somewhat different from that of the common potatoe, being much redder, and marbled with shades of deeper red. It was remarked, likewise, that the whole of the roots, confined themselves to a much less space of ground: the ramifications neither running so deep, nor spreading themselves out so wide, as in the common kind. Shoots of roots, with small tubers or potatoes upon them, sprang out, also, from the stalks of the herbage to a considerable height above the ground: and, whenever they reached the earth, grew very strongly; and again shot out branches with tubers, in the same manner as the original roots. This gave the most evident marks of an extraordinary prolific disposition in the roots; and another fact evinced it in a manner even surprizing. A potatoe happened to be left in a room, by the gentleman who had procured this trial of them to be made in Sion garden; and remained there about two months, during his absence in the country, exposed to the air of the room on a plate of stoneware. On his coming back, he found, without the assistance of any earth or moisture, but that attracted from the air, in a dry room with the windows shut, this potatoe had sent out a great number of small fibrous roots, and about sixty or seventy small tubers

bers or potatoes of various sizes, from that of a horse-bean to that of a small pea. These roots, afterwards, without any earth or water being put to them, made small shoots of herbage.—The potatoes, also produced in Sion garden were found heavier, and more solid, and sweeter in their taste, than the common sorts: which indicates that this kind is a more nutritive food to animals.—From the observations on these several facts it was presumed, that this potatoe might, at least, prove of greater utility in feeding cattle and hogs than the common sorts; if not afford, also, better and much cheaper food for the use of mankind; and, in order to introduce them to the public notice, some of them were carried to the Society for the Encouragement of Arts, &c. and submitted to the examination of a committee.—At that very time it happened, that Mr. Howard, a gentleman of fortune in Bedfordshire, had sent to the Society a quantity of the same kind of potatoes raised by him in different ways; and, with them, some account of the experiments and observations he had made, with respect to the culture of them.

The Committee, on the Inspection of the potatoes, and the consideration of the accounts of the facts laid before them, came to the following resolution: which, on being reported, was confirmed by the Society.

“ Resolved,

“ Resolved, it is the opinion of the com-
 “ mittee, that the kind of potatoes refer-
 “ red, of which Mr. Howard has given a
 “ most ingenious and instructive account, may
 “ prove a considerable improvement as well
 “ for the feeding cattle, as for the table, on
 “ account of their great increase and nutri-
 “ tive quality.”

As Mr. Howard presented the Society with a considerable quantity of the potatoes, they were distributed among such gentlemen as were desirous of cultivating them *.

In order to give a more distinct knowledge of what has been already discovered with respect to the culture and use of this potatoe, I will here give the Observations communicated to the Society by Mr. Howard ; and then subjoin some further Remarks founded on trials and experiments since made,

MEMOIR *on the Qualities and Cultivation of a NEW KIND OF POTATOE given to the Society for the Encouragement of Arts, Manufactures, and Commerce, by JOHN HOWARD, Esq. of Cardington, in Bedfordshire.*

“ AS I have the honour to be a member
 “ of this Society, I would beg leave to lay

* Mr. Shields, nursery-man, near Lambeth, procured, also, a sufficient stock to be able to furnish all such others as might be desirous of cultivating this kind of potatoe for use.

“ before

“ before it the account of my observation
 “ on the culture and extraordinary increase
 “ of a new kind of potatoe ; which was not
 “ known in England, as far as I can gather
 “ from the enquiries I have made, till I pro-
 “ pagated them.

“ In the year 1765, being at Clifton, near
 “ Bristol, I was informed a person had brought
 “ from America a new sort of potatoe ; and,
 “ with some trouble, I procured half a dozen
 “ roots of it : as the greatest part of those
 “ brought over were already planted. That
 “ autumn, I planted three of them, and in
 “ the following spring the other three, in
 “ my garden at Cardington, in Bedfordshire ;
 “ setting them in hillocks about six feet
 “ asunder.—The strength of the stems, and
 “ largeness of the blossom and apples, gave
 “ me the pleasing prospect of great increase :
 “ and, accordingly, when I took them up in
 “ the autumn 1766, I found they had in-
 “ creased far beyond any of the common
 “ sort, which for some years I had encour-
 “ aged our cottagers to cultivate.—The
 “ produce from each cutting was in weight
 “ from twenty-six to twenty-seven pounds
 “ and a half.—I sent for two of the Bedford
 “ gardeners, who serve the market, to see them
 “ taken up ; and they were surprised at the
 “ great increase. I gave some of them to
 “ these gardeners ; and others to almost all
 “ our own cottagers.—The increase con-
 “ tinued

“tinued to appear the same in the succeed-
“ing year, viz. 1767, as in the last: only,
“as many of the single potatoes had been
“then found to weigh four or five pounds
“each; I had now planted most of them in
“drills three feet asunder, in order to pro-
“cure a greater number, and a less size.
“Their produce was now from twenty-two
“to thirty pounds from each cutting: and
“the potatoes were more sizeable, for com-
“mon use. The vegetation was not so luxu-
“riant as in those I before planted in hillocks:
“but the increase of these was, allowing the
“cuttings to weigh one ounce, full four hun-
“dred fold.—Having last year upwards of a
“waggon-load of these potatoes, I with
“pleasure ordered it to be made publickly
“known, that every person who chose to
“cultivate them, were welcome to have a
“quantity for planting. In consequence of
“this, numbers applied in our own and the
“adjacent counties. In my plantations, as
“well as those of other persons, the increase
“has been still greater this year. For the
“season having proved very favourable, I
“have had, from some hillocks forty-one
“pounds and a half, allowing for dirt.

“I this year stript off many stems from
“the plants, leaving only two or three of
“the principal, in order to try if that would
“cause a greater increase of the roots. But
“this method did not succeed: as I found
“many

“ many rotten potatoes in the ground :
 “ which, probably, had been nourished by
 “ those stems I removed, till the time they
 “ were deprived of them.

“ I tried another experiment relative to
 “ transplanting of the roots. In June, I took
 “ up the whole root, which produced about
 “ six pounds of potatoes, I then stript all that
 “ were small ; and planted the stems in an-
 “ other place. At the usual time of taking
 “ them up, there was none less than eleven
 “ pounds ; and many that were fifteen,
 “ twenty, and twenty-five pounds. I tried
 “ the same with the common sort of pota-
 “ toes ; but did not succeed.—I would beg
 “ to make one additional remark, from many
 “ years careful observation it appears to me,
 “ that a cutting produces more and better-
 “ sized potatoes than a whole potatoe of the
 “ size of the cutting, put into the ground :
 “ yet a whole potatoe, three or four times as
 “ big as the cutting, produces rather more
 “ than the cutting.

Cardington, Bedfordshire,
 December 21st, 1768.

JOHN HOWARD.”

Mr. Howard, after the above, gave in a
 further account of his Experiments and Re-
 marks on this potatoe, and its culture, as
 follows :

Additional

Additional MEMOIR on the NEW KIND
OF POTATOE, &c.

“ IT may be proper to observe further,
“ that on poor ground, being either clayey, or
“ gravelly soil, where it has been found, on
“ trial, the common kinds of potatoes would
“ not grow at all, a small crop has been
“ produced of this new kind. On some-
“ what better soil, where a small crop of the
“ common sort has been produced a much
“ better crop of the new sort, even equalling a
“ middling one of the common, has been
“ raised. On a still better soil, the increase
“ has been yet proportionable: I have, in
“ short, found at the most moderate and
“ lowest estimation on all soils, that I have
“ known and tried, the increase to be full
“ three times as great as that of any of the
“ sorts of the common potatoes: though,
“ in some places, where I have planted beds
“ of each, that is of the common and the
“ new sort, adjoining one to the other, the
“ increase, these two last years, has been
“ about six times more of the new than of
“ the common.

“ Many hogs are greedy after all sorts of
“ potatoes: though some will not eat any.
“ They seem to prefer my new sort much to
“ the other: and I should think it more nu-
“ tritive, because an oiliness appears on the
“ water

“ water in which the potatoes have been
 “ boiled, that is not to be found in the com-
 “ mon sort.—For three years, that is, ever
 “ since I have raised this kind of potatoe, I
 “ have had them constantly at my table ;
 “ really preferring them to all others when
 “ well boiled : and though, perhaps, I may
 “ be partial to this kind, as I have taken so
 “ much pains to cultivate it ; yet many, and
 “ I do say most people, that have dined with
 “ me, have been of the same opinion. But,
 “ whatever judgment may be formed of
 “ these potatoes, when boiled ; yet, when
 “ roasted, they are far beyond any other
 “ kind : and the gardeners at Bedford in-
 “ form me, that all people, in general there,
 “ are fond of them, as appears by the great
 “ demand for them for this purpose.

“ I mentioned my planting the new po-
 “ tatoes in three feet drills, to prevent the
 “ luxuriant largeness of them : as, in the
 “ hillocks and outside rows, they grow to
 “ four, five, and six pounds, in rich soils.
 “ The reason of which I apprehend to
 “ be, that the sun, and air, not having so
 “ free access to the branches of the her-
 “ bage of the middle rows, the stems are
 “ evidently weaker ; and the potatoes pre-
 “ serve a far more useful size, viz. from half
 “ a pound to a pound : and those of the
 “ largest size are more a matter of curi-
 “ osity than of that real and general use to
 Vol. II. X mankind ;

“ mankind ; which ought ever to be the
 “ leading view with every considerate man.
 “ I must further remark one happy and en-
 “ couraging circumstance relative to the cul-
 “ tivation of potatoes. It is, that wet sum-
 “ mers, which are most detrimental to the
 “ wheat crops, are most beneficial to those
 “ of this root. I have seen it on that, as
 “ well as other accounts, very beneficial in
 “ my own neighbourhood : and I hope it
 “ will, in future time be, in general, a great
 “ relief, and help to a most valuable part
 “ of our fellow-creatures, the labouring poor
 “ in this kingdom. As I have found seeds
 “ from other countries produce very great
 “ crops the first year, and after that, almost
 “ quite fail *. I was willing to have three
 “ years full and cautious trial in this,
 “ and other soils, before I laid my Ob-
 “ servations before the Society : which I
 “ should have done some time before Christ-

* The degeneration, that is frequently found in
 plants raised successively by seeds, principally arises from
 their receiving the farina fecundans of some other kind
 nearly allied to them, and cannot consequently happen
 on the same principle in the case of cuttings, or off-sets :
 and they, therefore retain the qualities of the parent
 plants, except when changed by difference of soil, cli-
 mate, or other exterior accident. But, as this kind of
 potatoe had been lately brought hither from America,
 Mr. Howard's precaution was proper till it had been ob-
 served, how far the habit of the plant was subject to be
 gradually changed in this country. R. D.

“ mas

“ mas had I come to town from Carding-
 “ ton. But, being now fully convinced of
 “ this very useful and prolific plant’s not-de-
 “ generating, I, with great pleasure, submit
 “ it to the consideration of this learned and
 “ ingenious Society.

Cardington, Bedfordshire,
 February 15, 1769.

JOHN HOWARD.”

N. B. “ I must not omit to mention, with
 “ respect to the new potatoes which I
 “ planted in drills, that those drills were
 “ three feet asunder; and that I planted
 “ the cuttings, also, three feet distance from
 “ each other for these last two years.

“ There is one advantageous circum-
 “ stance relating to this kind: which I
 “ omitted touching on before. It is the
 “ manner of growth of the potatoes: which
 “ crowd, as it were, altogether; and very
 “ few small ones are produced. This
 “ affords the means of entirely eradicating
 “ them; and exchanging their place of
 “ culture at will: whereas I have ever
 “ found the doing it very troublesome
 “ with all the common sorts of potatoe.”

It has come to light from further infor-
 mation, obtained since the specimens of this
 kind of potatoe were first laid before the so-
 ciety, that it has been brought into England

at different times ; and cultivated by a few persons in several places, but rather as matter of curiosity than of use.—Amongst other authentic accounts, one has been given, that some of these potatoes have been raised in Dorsetshire, where the lower people seemed more fond of them than of the common kind : but they were not equally approved of at the tables of people in higher life.—The cultivation of them has not, however, been spread much any-where, except in the neighbourhood of Mr. Howard, in consequence of his endeavours to that end ; and, in a less extensive manner, in one part of Northumberland, as above-mentioned : in both which places, the meaner people have expressed much more liking to them than the superior.—It is not to be wondered at, that, notwithstanding the advantages of this kind of potatoe over the common, the cultivation of it has not been more adopted in the places where it has been made known. For potatoes, in general, have been but little regarded in Great Britain as an article of husbandry, unless in particular parts of the country ; and even there, scarcely ever but with a view of selling them for the table : and the uneven, clustered figure of this kind, together with the redness of the inside, makes them exceptionable at market to those, who are not acquainted with their good qualities. This has been found on more than one
trial

trial near London ; and will be an obstacle to their being raised by gardeners ; but not to their being cultivated for feeding cattle or hogs, in which case they are consumed by the persons who raise them ; or by those, who may be easily informed of their properties.

It is to be hoped, however, that time will remove all the difficulties to the rendering the cultivation of this valuable kind of potatoe general : as it may prove of the greatest utility in husbandry for the feeding cattle and hogs ; and furnish a very cheap article of wholesome diet for the common people : as will appear when we take the following review of the more advantageous qualities it possesses, compared with the sorts usually cultivated.

The Bedfordshire potatoe is unquestionably much more prolific than the common kinds. For a number of trials made by others this last year have confirmed the truth of Mr. Howard's observations ; and have manifested, that its increase and comparative product is much greater. This renders a crop of it exceeding large on very good land : but we have not any account of its being hitherto cultivated with all the same advantages as the very best crop of the common potatoe ; and, therefore, cannot positively determine what the most copious product may amount to. This quality of affording a much greater crop than the common potatoe on the same space of

land of any kind, is the first and principal advantage of it.

But from this prolific quality of the Bedfordshire potatoe, there arises another collateral benefit: which is, that, as it yields, on land of middling degree of richness, a produce equal to that of the common kinds on land of the first degree, those farmers, who have not land naturally rich, or who cannot spare much manure, may yet be able to cultivate this kind; and even with greater profit than those who raise the common kind on rich land: as the amount of the difference of the rent of the land, or value of the manure, will be saved. This renders the cultivation of it as suitable to farmers of narrow abilities, who only occupy land of middling quality, as any other crop.

The potatoes, produced by the root of the Bedfordshire kind, grow much closer together and nearer the surface of the earth than those of the common kinds. Whence they may be taken up with less labour and expence: and, as Mr. Howard has observed, in the above-given Memoir, the land may be more readily and effectually cleared from the remains of them, in order to make it fit for a succeeding crop of any other kind.

The potatoes of the Bedfordshire kind are much more liked by hogs than the common kind: as appears from the hogs being so strongly allured by the scent of them, that they

they can scarcely be kept, by any fence, from breaking into the fields, where these potatoes are growing. Hence, as the proportion, the hogs will eat of them, will be greater than that of the common kind, they will grow sooner and more fat with them. It appears from some trials, that cattle have, likewise, the same preferable liking to them; which will of course be attended with the same consequence as to their growing fat from them.

They are, also, more nutritive than the common kinds: as may be concluded from their being more solid, heavy, and sweet; and from their containing more FARINA, or flour: which has been proved by experiment.

On this enumeration of their qualities, and the profitable application of them, the Bedfordshire kind seems to answer the whole of what was wanted, to render the use of the potatoe, as a food for cattle, and hogs, either for rearing, feeding, or fattening them, a most important improvement in agriculture. And could the common people here be brought, in general, to have a liking for them, they would be a very cheap food, and a security against the mischiefs of accidental scarcity of corn. They would also produce a national gain; as that quantity of grain they would save, would be spar-

ed, for exportation. Indeed, as an esculent plant, they have great merit, in every respect, but their appearance. When boiled thoroughly, they are equally well tasted, and white, with the common potatoes; tho', under-boiled, they have somewhat of the sweetness of the Jerusalem artichoke, and retain their reddish colour. When roasted, they are allowed on all hands to be preferable to the common kinds.

The method of culture of the Bedfordshire potatoe recommended by Mr. Howard is, on the whole, the best in general that has been tried.—On soils, that are not very rich, the cuttings may, however, be placed closer by half a foot or more than he mentions. Because the herbage, being less luxuriant than on rich ground, the air will have sufficient access to the stalks. But in rich lands, the facts, he mentions, clearly shew, that his distance is a good one.—It must be allowed, indeed, that the space of land he proposes, would admit sufficient room for the roots, if they were much closer; and, also, for horse-hoeing the intervals. But, in most cases, where the roots constitute the crop, regard must be had to the flourishing state of herbage; which depends, in a considerable degree, on the not obstructing the freer passage of the air: otherwise the roots will fail of their due growth, and
proper

proper qualities. This is apparently the case of the potatoe, from the facts mentioned by Mr. Howard, both with regard to the superior size of the potatoes, in the outward rows : and the rotting of part of the roots, when he took away part of the stalks.—The proper medium, therefore, lies betwixt losing too much ground, by having too few plants ; and increasing the number so much, that the roots will not have proper nourishment from the herbage on account of its want of free air ; and, therefore, not yield a due product as to number, or the size of potatoes.

ARTICLE

ARTICLE XVI.

*A CATALOGUE of the MACHINES and
MODELS in the Repositories of the Society
for the Encouragement of Arts, Manufac-
tures and Commerce *.*

* The Society have procured, by their premiums, bounties, or the favour of gentlemen, who have been incited to promote their views, a very ample collection of machines and models. Of these, several are wholly of new invention: others are improved constructions of such as were before made in a less perfect manner: and some, though not of very late invention or improvement, are such as were so little known, that they may be considered in relation to the consequences of bringing them to light, as new with respect to the public. Among them are many, that are of approved utility, as well with regard to agriculture and manufactures, as other œconomical purposes; and some, which, though they are not at present brought to practical perfection, may yet furnish such lights, as will lead to a complete application of the principles in future attempts. — The advantage the public may derive from this collection can, however, actually be only in proportion as the particulars of it are made generally, and minutely known; and it is this limitation, together with the difficulties of removing or obviating it, that prevents the very great benefits, which otherwise would speedily accrue from the Society's endeavours. — They have, indeed, printed such a catalogue as is here given for the use of the members, or such persons as have liberty to inspect the machines. But it is only few others who know there is a Catalogue of that kind: and many who are remote from London, to whom some of the machines might be the most useful, have not any easy means of procuring it. In order, therefore, to promote the views of the Society, and comply with the request of several gentlemen, who have expressed their desire that the Catalogue should be inserted in this work,
I have

CLASS I.

Machines and Models, subservient to Manufactures.

I. **A** New invented Comb-pot, by Mr. S. Hayward, for which the Society gave him a bounty of thirty guineas, April 13, 1763*.

II. A longshed Spinning-wheel, by Mr. Thomas Perrin; for which he had the first premium of thirty pounds, April 8, 1762.

III. A Spinning-wheel, by Mr. John Webb; for which he had a premium of twenty pounds, March 25, 1761.

IV. A Spinning-wheel, by Mr. Thomas

I have here given it, with a few brief observations on some of the most important articles. This was all that could be done at present, as the number of other matters, which could not be properly omitted, did not leave room for more in this volume: but a future opportunity of exhibiting prints of the principal machines, and explaining their use and manner of application, will be taken.

* This Comb-pot for heating the irons used in wool-combing, by means of a furnace heated with pit-coal, and free from the noxious fumes of the charcoal burnt in the common comb-pot employed for that purpose, is described, and its advantages explained in page 163 of the first volume of these Memoirs. It is sufficient to say here, that it performs its office much cheaper and better than the common comb-pot: and preserves the health of the workmen, which is liable to be much injured by the others.

Perrin;

Perrin; for which he had a premium of ten pounds, March 25, 1761.

V. A Horizontal Spinning-wheel, by Mr. William Harrison; for which he had the first premium of fifty guineas, April 11, 1764 *.

VI. A Spinning-wheel, by Mr. Perrin; for which he had the second premium of twenty pounds, May 6, 1765.

VII. A Spinning-wheel, by Mr. Garrat; for which he had thirty pounds, part of the premium of fifty pounds, April 9, 1766.

VIII. A Spinning-wheel, by Mr. Garrat; for which he had fifteen pounds, part of the second premium of twenty pounds, April 9, 1767.

* This Spinning-wheel is for the common purposes of spinning wool, flax, or cotton; and has been deemed a great improvement: as it is adapted to the spinning with both hands; and performs that office in a very complete manner. It was on that account introduced into use in the Foundling-hospital: and is greatly accommodated to the purposes of work-houses, or other establishments of a similar nature, where a number of hands are to be employed; and the work is to find or rather force its way to market by its being cheaply disposed of. The advantage of a method of spinning with greater dispatch than by the common wheel, is very momentous to the public in the present circumstances of the encrease of the price of labour, as it may support those manufactures, which are dependant on spinning, that would otherwise be lost on that principle. For it will not only occasion more work to be done by the same hands; but encourage a greater number to apply themselves, from the augmentation of the profit which the greater dispatch will produce.

IX. A

IX. A Machine for Winding and Doubling Worsted, by Mr. Jeremiah Burrows; for which he had ten pounds, part of the premium of seventy-five pounds, April 17, 1765.

X. A Machine for Winding and Doubling, by Mr. Cager; for which he had ten pounds, part of the premium of seventy-five pounds, April 17, 1765.

XI. A Machine for Winding and Doubling, by Mr. Garrat; for which he had twelve pounds, part of the the premium of twenty-five pounds, April 9, 1766.

XII. A Reel for Winding Silk from the Cocoons, by Mr. Verrier; for which he had a bounty of forty pounds, June 14, 1762.

XIII. A Silk Reel, presented to the Society, by John Pownall, esq.

XIV. A complete Frame and Reel, with a Bason and Furnace, for Winding Silk from the Cocoons, agreeable to the present best method of working in Italy *.

* This reel with the apparatus, constructed according to the greatest improvement of the Italian practice, is the most complete hitherto introduced into use; and is absolutely essential to the producing the best silk. The want of such a proper set of implements of a perfect construction is the cause of a great part of the silk produced in most places of the world being of considerable less value than it would be if they were employed. Whoever would succeed in their attempt to the production of silk, therefore ought to be provided with such an apparatus; or they will find their endeavours frustrated, when they come to wind off the cocoons, they have obtained, however good they have rendered them by a careful and judicious management of the worms.

XV. A

XV. A Model of a Loom for Brocades, by Mr. Sebastian Favie; for which he had a bounty of three guineas, October 27, 1761.

XVI. A Stocking Frame, by Mr. Samuel Unwin; for which he had a premium of one hundred pounds, February 14, 1765*.

XVII. A Stocking Frame, by Mr. Whyman; for which he had a premium of one hundred pounds, April 16, 1766†.

* This stocking-frame was deemed an improvement of those commonly used for work that is not very fine. It is, according to the judgment of the Society, much more simple than the common frames; can be made at one third of the expence; and may be used with much more ease, and safety from damaging the work, by young practitioners. Its advantages are, however, less extensive than those of the next article: which was produced in claim of the premium the following year.

† This stocking-frame is a very great and complete improvement of that important kind of machine. It has many advantages over the common stocking-frame, the principal of which are, that it is more durable, lighter, and cheaper; that it is so easily wrought, as to admit of a man's continuing his labour three or four hours in the day longer than with the common frame; and that it will allow of any degree of fineness in the gage without the least difficulty. These were proved in the decision of the claim of the premium, which the inventor of the machine obtained for it, by the attestation of a number of the best judges in this matter, given in consequence of the trials made of it.

CLASS

CLASS II.

Models of Mills, Cranes, Machines for raising Water, Carriages, and other Machines, and Implements not reducible to any particular Class.

I. **A** Working Model of a Saw-mill, by Mr. James Stainsfield; for which the Society gave him one hundred pounds, and ten guineas for an improvement by adding a Cross-cutting Saw, December 12, 1765.

N. B. The original Mill, of which this is a model, was erected and worked for five years, in consequence of successive premiums offered, and paid by the Society; amounting in the whole to the sum of two hundred and twenty-five pounds *.

II. A Hand-mill, for grinding Corn, by Mr. John Gordon.

III. A Steel-mill, for grinding Corn, by Mr. Peter Lyon. The premium of fifty pounds was equally divided between these two candidates, January 11, 1758.

* The Saw-mill. which was erected by the late Mr. Charles Dingley at Lime-house, and is now wrought there, was executed according to this model under the direction of Mr. Stainsfield; and is esteemed to be the most complete in its construction of any hitherto made. Another model similar to this, and made, also, by Mr. Stainsfield, was sent to America, by the Society, for the improvement of those erected there.

IV. A Hand-mill, by Mr. Samuel Parsons; for which he had a premium of fifty pounds, December 6, 1758.

V. A Hand-mill, by Mr. Charles Lloyd; for which he had a bounty of fifty pounds, and twenty pounds allowed him for his expences, June 17, 1761.

VI. A Hand-mill with improvements by Mr. William Bailey; made by order of the Society from one brought from S. Cas, by his royal highness the late duke of York, April 11, 1760 *.

VII. A Model of a Wind-mill, by Mr. James Verrier; for which he had a bounty of fifty pounds, December 31, 1761.

VIII. A Model of a Wind-mill, by Mr. Lewis; for which he had a premium of fifty pounds, October 7, 1761.

IX. A Model of a Machine for raising Water, by Mr. Merryman; for which the Society gave him a silver medal, February 26, 1766.

X. A Model of a Wind-mill, by Mr. Nichols, April 23, 1760.

XI. A Model of a Wind-mill for Draining Land; presented to the Society by Mr. Collier, May 31, 1758.

* All these mills were found too imperfect to answer the end effectually; but Mr. Lyon has since much improved that of Number III: and it is now deemed an useful machine by several who use it. But there is another steel hand-mill specified below, Number XLVI. which, on trial appears to grind the corn very fine, and without greasing, as it is called; that, is heating the flour so as to make it adhere.

XII. Ditto

XII. Ditto by ditto; for the same purpose *.

XIII. A Trough and Wheel, by ditto; more fully to explain N^o XI.

XIV. A Model of a Tide-mill, by the Rev. Mr. Gainsborough; for which he had a premium of sixty pounds, June 1, 1761.

XV. A Model of a Tide-mill, by the Rev. Mr. Lord; for which he had a bounty of ten guineas, May 21, 1761.

XVI. A Model of a Tide-mill, by Mr. Coulthard. This Model was purchased by the Society for twenty pounds, May 12, 1762.

XVII. A Model of a Tide-mill, by Mr. Nichols; for which he had a premium of thirty pounds, April 19, 1760.

XVIII. A Model of a Machine for boring auger-holes, by William Bailey; for which he had a bounty of fifty pounds, April 19, 1760.

XIX. A Model of a Crane, by Mr. Galabine; for which he had a reward of twenty guineas, January 28, 1760.

XX. A Model of a Crane with three powers, by Mr. James Ferguson; for which he had a bounty of fifty pounds, February 25, 1762.

* This gentleman, in consequence of the reputation he had gained by his improvements of machines for draining, was engaged to go over to Holland to carry them into execution there.

XXI. A Model of a Crane, by Mr. San-son ; for which he had a bounty of ten guineas, December 18, 1765.

XXII. A Lock, by Mr. Moore, for which he had a bounty of twenty pounds, March 2, 1763.

XXIII. A Model of a Four-wheel Carriage, by Mr. Cotton ; for which he had a bounty of twenty guineas, November 13, 1767.

XXIV. A Model of a Four-wheel Carriage, by Mess. Cranefield ; for which a bounty of thirty guineas was given, May 20, 1765.

XXV. The implements used by the Dutch in the Turbot Fishery.

XXVI. A Model of a Four-wheel Fish Carriage, by Mr. Stephen Boulton ; for which he had the premium of twenty pounds, May 12, 1762.

XXVII. A Model of a Two-wheel Fish Carriage, by ditto ; for which he had the first premium of fourteen pounds, May 12, 1762.

XXVIII. A Model of a Two-wheel Fish Carriage, by Mr. Joachim Smith ; for which he had the second premium of seven pounds, May 12, 1762.

XXIX. Two Machines (exactly similar to each other) for trying Ships Blocks, made by Mr. William Bailey, under the direction of Mr. Gardener, November 6, 1761.

XXX. A Model for a Machine for raising Water by means of a spiral Tube, by Mr. Wirts,

Wirts, communicated to the Society by Mr. Zeigler; for which Mr. Zeigler had the gold medal of the Society, January 6, 1768*.

XXXI. A Model of an Apparatus for saving the lives of men aboard of ships, stranded on a lee shore, by Mr. John Winn; for which he had the silver medal of the Society, February 25, 1767.

XXXII. A Compass and Protractor, by Mr. Aaron Miller; for which he had a bounty of ten guineas, February 11, 1767.

XXXIII. Model of a Machine † for grinding and polishing Glass by horse, wind, or water; by Mr. Jeremiah Burrows, purchased by the Society for twenty pounds, June 10, 1767. The original, of which this is a model, was kept at work three months, in consequence of the Society's premiums; for which Mr. Burrows had seventy pounds, May 20, 1765.

XXXIV. A Machine for taking Heights and Distances, by Mr. Grant.

* Mr. Zeigler has since made great improvements in this machine, and a new model has been presented to Society by him.

† This is not only a very ingenious machine, but very effectual for the purpose: and it is much to be regretted that, after the expence the Society have been at in procuring the invention and erection of such a machine, it should not be continued at work: as it would tend to lower the price of several material articles of commerce.

A more particular account of this momentous improvement is given in the first Volume of this work, page 160.

XXXV. An expanding Rod for gauging vessels, by Mr. Efford; for which he had a bounty of fifteen pounds, February 3, 1768.

XXXVI. A Pair of Door-hinges with spiral Springs, by Mr. Delivitz; for which he had a bounty of fifteen pounds, February 3, 1768.

XXXVII. A Model of proper Work to be added to Wheel-cranes to prevent the hazard of men being killed or maimed, by Mr. Pinchbeck; for which he had a gold medal, June 3, 1767.

XXXVIII. A Model of a Machine presented to the Society by Keane Fitzgerald, Esq. May 25, 1768.

XXXIX. A Model of Dr. Hale's Ventilator, presented to the Society by Mr. Thomas Yeomans, Nov. 30, 1768.

XL. A Model of a Machine for making Wheel-tyre, by Mr. Hunt, for which he had a bounty of ten guineas, June 6, 1769.

XLI. An Instrument for gauging Vessels, by Mr. Efford; for which the Society gave him a bounty of fifteen guineas, June 6, 1769.

XLII. A Machine for dressing Flour, purchased of the inventor Mr. Evers, January 4, 1761.

XLIII. A Cyder-mill purchased along with the Press specified in the next article of Mr. Charles Lloyd the inventor, for twenty guineas, March 25, 1761.

XLIV. A

XLIV. A Cyder-press, purchased of Mr. Charles Lloyd the inventor, along with the Cyder-mill specified in the foregoing article, for twenty guineas, March 25, 1761.

XLV. A Model of a Machine for dressing Wheat and Malt, by Mr. Machell; for which he had a bounty of fifty pounds.

XLVI. A Hand-mill for grinding Corn presented to the Society by Messieurs Treeth of Birmingham, May 10, 1769 *.

XLVII. A Machine for raising Water out of Mines, by Mr. Westgarth; for which he had a bounty of fifty guineas, May 31, 1769.

XLVIII. A portable Corn-oven, by Mr. Robert Clements; for which he had a bounty of fifteen guineas, January 17, 1770 †.

XLIX. A Machine for bolting Meal, by Mr. Nathaniel Stedman; for which he had

* It appears on accurate trials, made by the Society, that, with a common hand, about a peck and a quarter of wheat may be ground in this mill in one hour, and the quantity of bran it produces from good corn is very small. It is not subject to be out of order; will last many years without material repair; and the parts which are liable to be worn out, may be renewed at a moderate expence.

† This oven, on repeated trials, has been found to answer perfectly as well for baking bread, as other things.—It almost wholly saves the expence of fuel: being heated with a very small proportion of pit-coal or cinders: and the bread is much sweeter, and freer from the taste of smoke than when baked in a common oven. The price of an oven of this kind of a moderate size, is five guineas.

a bounty of fifteen guineas, January 1st, 1770 *.

L. A Pump of a new construction by Mr. Blanford: for which, he had a bounty of fifteen guineas, March 28, 1770 †.

C L A S S III.

Machines, and Models, subservient to Agriculture.

I. **A** Model of a Machine for drying Madder; presented to the Society by Mr. George Rutt, May 11, 1763.

II. A Bee-box; presented to the Society by Charles Whitworth, esq. Vice President, March 1, 1763.

III. Two Brabant Scythes, for reaping Corn of different sorts; presented to the Society by William Hanbury, esq.

* This bolting machine is of very great utility both with respect to the dispatch, and perfection with which it executes its office. It takes up very little room; prevents even the least waste of the flour or bran; and can be wrought with exceeding little force; so that a boy or girl may be employed to work it.

† The peculiar merit of this pump is, that the valve is so contrived as to avoid the choaking and stoppage of the passage, though any quantity of gravel, or any other foulness, be in the water to be raised by it. This renders it of great utility in many cases: particularly at sea, where an obstruction of the pump may sometimes occasion great hazard. Along with this valuable quality, it appears, on experiment, to work with at least equal ease, and efficacy as the best pumps on other constructions.

IV. A

IV. A Model of a Plough for turning up Heath Ground, by Mr. Ringrose.

V. A Model of a Thistle-cutter, by Mr. Ringrose; for which, and the above, he had a bounty of ten guineas, March 16, 1763.

VI. A Land-roller; presented to the Society by Mr. Scawen, of Carshalton, Surry, August 5, 1761.

VII. A Model of a Plough with fix Shares and Coulters, by Mr. Robert Gee, May 13, 1767.

VIII. A Drain-plough, by Mr. Cuthbert Clarke; for which he had a premium of fifty pounds, October 8, 1766.

IX. A Drain-plough with improvements, by ditto; purchased by the Society, June 1, 1767.

X. A Drain-plough, by Mr. William Knowles; for which he had a premium of fifty pounds, May 20, 1767.

XI. A Drill-plough, by Mr. Chateauvieux *.

* A particular account of this plough is given in vol. I. of this work, page 86. This construction of a plough appears from its actual application, on many occasions, where deep trenching, or turning up the ground is requisite, to be of great utility. But it is not so well accommodated to the purpose of making trenches for close drains of the kind commonly called bush-drains, as was at first imagined. Later observation and experience have shewn, that such drains ought to be considerably deeper, and narrower in every part, but particularly much so at the bottom, and with less slope in the lower part of the sides: which both diminishes the expence of filling the drains with bushes, or whatever matter is used for that

XII. A single Cultivator, by Mr. De Chateauvieux.

XIII. A double Cultivator, by Mr. De Chateauvieux.

XIV. A Scarrificator; presented to the Society by Mr. John Winn Baker, of Ireland, April 8, 1767.

XV. A Drill-plough, by the Rev. Mr. Gainsborough; for which he had a premium of thirty pounds, May 14, 1766.

XVI. A Drill-plough, by Mr. Willey; for which he had a premium of twenty pounds, May 14, 1766.

XVII. A Drill-plough with improvements, by Mr. Willey, purchased by the Society, June 24, 1767 *.

XVIII. A Horse-hoe for destroying weeds; invented by the Rev. Mr. Hewit.

XIX. A Horse-hoe, for destroying weeds, with an harrow annexed to it; being an improvement of the preceding.

purpose; and renders the turf less liable to be forced in, by any violence on its surface. The plough below mentioned N° XXXIII. is, therefore, much fitter for this purpose; and, with some improvements, may be made a good machine for this purpose.

* This is esteemed the most complete drill-plough produced to the Society, taking the extensiveness and efficacy of its operation together. There are others which are simpler, cheaper, and perhaps equally well accommodated to particular purposes: but none which are so fit for all the ends, this is intended to answer.

XX. A

XX. A Machine for winnowing corn, purchased of Mr. Evers*.

XXI. A Machine for eradicating Trees; presented to the Society by Mr. Valtravers.

XXII. A Machine for slicing Turnips, by Mr. Edghill; for which he had a premium of twenty pounds, December 10, 1766 †.

* This machine takes up but a small space, considering the office it performs. It winnows the corn perfectly, and not only frees it from chaff and dust, but separates the light grains from the sound. It is easily wrought by one person; requires no wind or air, but that of its own fan; and does not in the least incommode the person working with the dust. It is, therefore, a very useful machine, both on account of its complete performance, and the saving it makes in labour and trouble. The original inventor of it is not known. As it was first used in Holland, and afterwards introduced into some parts of Scotland: whence it found its way to Northumberland, and at last into Yorkshire, where improvements were made in it by Mr. Evers, who disposed of a number of the machines in that and the neighbouring counties. It did not, however, come further south till brought by the Society, who purchased one of Mr. Evers to make it known to the public. Fewer have, nevertheless, been introduced into use than might be expected from so valuable an improvement of the manner of winnowing corn.

† This machine, and its utility, are treated of in the first volume of this work, page 82. It is a very ingenious construction, and completely effectual to the purpose, where a machine is invented to answer this end. There is a great division of opinion respecting the expences of slicing turneps for cattle. The Society has attempted no discussion of that point, but only provided the means of doing it with great facility, and without the danger of frequent bad accidents which attended the slicing turneps by hand, for those who embrace this practice.

XXIII. A

XXIII. A Perambulator for measuring roads, by Mr. Edgworth; for which he had a silver medal, April 8, 1767.

XXIV. A Model of a Field-gate, by Mr. Thomas Orm; for which he had a bounty of ten pounds, April 3, 1766.

XXV. A Trenching - plough by Mr. Duckett; for which, together with the, Three-Furrow Ploughs in the next article he had a bounty of fifty pounds, June 24, 1767.

XXVI. A Three-furrow-plough; for which, together with the Trenching-plough, in the preceding article, he had a bounty of fifty pounds, June 24, 1767.

XXVII. A Model of a Machine for threshing Corn, by Mr. Evers; for which he had a bounty of fifty pounds, February 3, 1768.

XXVIII. A Model of a Machine for making close Drills, by Mr. Bestland; for which he had a bounty of ten guineas, February 22, 1769.

XXIX. A Model of a temporary Barn, presented to the Society by Richard Lovel Edgworth, esq.

XXX. A Drill for sowing Turneps, presented to the Society, by John Arbuthnot, esq. May, 1769.

XXXI. A Drill-plough, which sows the seed, and deposits along with it any kind of manure reduced to the state of a powder,

by Dr. Benjamin Gale: for which he had a gold medal, January 10th, 1770.

XXXII. A Drill-plough, by William Craick, esq. for which he had a gold medal, January, 10, 1770.

XXXIII. A Plough for making trenches for close Drains, by Mr. William Makings; for which he had a bounty of fifty guineas as a reward for his invention and disclosure of it for the benefit of the public; and ten guineas for the making a complete Plough and Carriage *.

C L A S S IV.

Machines and Implements, subservient to Chemistry.

I. **A** Digester, by Mr. Creagh; for which he had a bounty of thirty guineas, December 1, 1762.

* This plough was found, on trial, to have great merit in its present state; and, with some improvements already well conceived, will be a good machine for answering the intended purpose. It appears, that in land of moderate tenacity and resistance, it can be wrought with four horses, under the direction and guidance of a man and a boy. It will, after the turf is removed make about fourteen hundred feet of trench in an hour without the horses going a greater pace than they are able to hold in a whole day's work. The trench will be seventeen or eighteen inches in depth, ten inches wide at the top, and two and a half or three at the bottom. But the plough is so constructed by means of several shoulder-boards, which may be shifted, that the width and slope may be varied at pleasure.

ARTICLE

ARTICLE XVII.

OBSERVATIONS *on the Culture and Use of Timothy-grass, Bird-grass, Burnet, the Turnep-cabbage, and the Turnep-rooted Cabbage; communicated by the Rev. Mr. LAMBE, in a Memoir, to the Society for the Encouragement of Arts, Manufactures, and Commerce; and inserted at their Request.*

To Robert Dossie, Esq.

SIR,

THE Society for the Encouragement of Arts, Manufactures, and Commerce, have directed me to deliver to you, Mr. LAMBE's Observations on Bird-grass, &c. in order to its being inserted in the Memoirs of Agriculture, if you think proper.

I am your very humble Servant,

SAMUEL MORE, sec.

To

To the right honourable the President, Vice-Presidents, and other Members of the *Society for the Encouragement of Arts, Manufactures, and Commerce*, this Paper is addressed by their most obedient humble Servant DAVIES LAMBE.

IN August, 1765, I sowed half a pint of Timothy-grass seed in my garden. By the latter end of September following, it was quite matted upon the ground; and, without much progress, continued in that state all the winter. In May, 1766, I planted near an acre of ground with this bed of grass: which, as it was a very dry summer, I was obliged to water every day for a fortnight, till the plants struck root: but they then flourished so exceedingly, as to give me great hopes of saving some seed from it. In July, the grass was five feet high, and the ears of it seven, eight, and nine inches long: and, at a distance, it had the appearance of a field of wheat. In August, being ripe, it was cut, and threshed in the field; and yielded fifty pounds of seed.

April 1767, having plenty of seed, I sowed a field of wheat with it. It came up very thin: so that I did not think it worth the saving; and accordingly, plowed it up the following spring.

To know the goodness of this grass, in March 1767, I ploughed up a very wet weeping

weeping spot, scarce half an acre, in the middle of a seven-acre field of St. Foyn; and sowed it with Windsor-beans in rows: the intervals being well hoed, and very clean and fine. In May, I sowed this spot with Timothy-grass: which took very well. At the same time, in another part of the field, I sowed much about the same quantity of ground with burnet. In the following spring, May 7th, 1768, I turned my horses, cows, and sheep, into this pasture; and observed them for a considerable time, in order to determine which was the sweetest grass. After a little rambling, they one and all fixed upon the Timothy; and continued there till it was as bare as a common. They then fell upon the Burnett; and eat that off before they ever eat much of the St. Foyn. This Timothy was sown broad-cast: and, though I have encouraged it with foot and coal-ashes, it affords a very slender crop of pasture; and is, I think, not worth cultivating on good dry land *. What it may do on very

* The Timothy-grass is naturally produced in wet ground: requiring a considerable share of moisture for its due support. Where so situated, it grows luxuriant; and continues as long as any species of grass whatever: propagating itself freely, as well by its roots, as seed. But where this share of moisture is wanting, it dwindles; and, in case of a great driness, dies. It cannot, therefore, be expected to succeed on dry, though even rich land: as every drought must prove more or less injurious; and either diminish, or wholly destroy it. R. D.

boggy,

boggy, wet, and mossy land of little or no value, I know not : but I am inclined to think it would flourish * there; and be a considerable improvement.

Bird-grass, or fowl-mead grass, I have a much better opinion of. As the seed was very dear, (four guineas per pound) when I first made any experiment upon it, I did not venture to buy more than one ounce of it: which I sowed July 12th, on a bed of very fine rich ground in my garden : and though I gave it very little raking, and covering, as little almost as possible, I gave it, I am sure, by after-experience, too much. Very little of it came up; that little was well taken care of: and, before Michaelmas, it had stocked so much, that I separated every root; and fresh-planted it. It flourished in a surprising manner, vegetated all the winter, and, by the beginning of March was full as strong, as when I first divided it in autumn.

* It appears from the accounts of those, who have had opportunities of observing the fact, that this conjecture of the utility of Timothy-grass cultivated on boggy land, is just. For this grass not only produces a very copious burthen on such land, where scarcely any thing else could be obtained; but gives, by the turf formed of its matted roots, so great a firmness to ground, that would before neither bear the tread of cattle, or men, as to admit even of the weight of carriages, after the roots have had a due time for their growth.—The full advantages of Timothy grass, under these circumstances, have not, however, been hitherto clearly ascertained to the public, by accounts of sufficient trials made with care and judgment. R. D.

The

The latter end of March, when I was in high expectation of seeing it stock and flourish, it began to turn yellow; and more and more so every day. I wondered much at the strange alteration: and, to try if possible to know the reason of it, I dug up a very strong plant, with near one hundred blades, but growing yellow within twenty-four hours. For I had marked this plant the day before, by setting up a stick very near it. I soon discovered the reason of this visible and daily decay, viz. Nine or ten wire-worms, as we call them in Kent, in the very heart of the root. Upon this discovery, I immediately ordered three men to dig up the whole plantation. There was scarce a single root without one or more of these wire-worms. I then destroyed these pernicious animals; had the roots divided into as many plants as possible, and had the whole replanted in rows, of a foot square: this operation restored the plants to a state of such vigour and strength, that the ground was entirely covered with the grass before Michaelmas; and yielded me several pounds of fine seed.

Mr. Roque has often complained to me of the great difficulty of making seed of bird-grass grow: and not without reason. After trenching half an acre of very rich land, and sowing it with this seed, he had not so many plants, as I had from one ounce of it. He
imputed

imputed this to his trenching the ground too deep : by which means a dead stinking earth was thrown upon the surface, in which nothing would vegetate. There may be some reason for this : but I rather think the failure owing to his covering the seed too deep. As it is a certain fact, that it comes up very well when not covered at all. An accident demonstrated the truth of this. I had about a dozen of fine plants in my garden; when the seed was ripe: and they were cut, and laid upon the ground. Wet weather following prevented my harvesting it properly: and when fine weather did come, our attention was employed to take care of the corn-harvest. The bird-grass neglected and forgotten, lay on the ground near three weeks: in which time, it was grown, and had taken root so firmly in the ground, as not to be removed without pulling it to pieces. Ever since this discovery, I never cover the seed: and it never fails growing full as well as any other grass-seed. I have been the more particular with regard to the cultivation of this grass: as I am in great hopes, it will turn out a great acquisition * to husbandry; especially for upland meadow. It

* There is so great a variation in the product of cultivated vegetables from accidental circumstances, that very little stress can be laid on single and small trials. The bird-grass has been raised, and subjected to comparative examination with other kinds of grass by very good judges: who have not found it to answer the re-

is a very fine, sweet, silky grass; throws out a very great crop; produces a great quantity of seed; and the hay is exceeding good after the seed is threshed out of it. I had, from one rood of ground, last year, a hundred weight of seed, and a very large load of hay. What is very remarkable, the seed is quite naked: having very little or no chaff adhering to it.

As to burnet, I have sown very little since the year 1764: when I laid down a field of seven acres with it. The first three years, I mowed it for seed. The produce of which was, the first year, sixty facks; the second forty; and the third, twenty. It has been a pasture, these last two years; and has answered, as such, exceeding well. It is now very full of grass*; which gains upon it

commendations given of it by Mr. Roque, and its former advocates.—I have, myself, seen more than one instance of its inferiority to several species, cultivated separately on the same piece of ground. It is probable, nevertheless, that the manner of sowing, which in those cases, was in drills, where it was deep covered, might, according to what Mr. Lambe has above observed, contribute to its sparing-crop: and, perhaps, it might not happen to be placed on a soil, the most favourable to it. As Mr. Lambe has had the encouraging prospect afforded by the rood he mentions, it is to be hoped he will pursue his experiments on a larger space of the same ground. For should his expectations be answered in the sequel, such a species of grass would be a great acquisition for separate culture: and the beautiful lasting verdure of this kind would be an additional recommendation of it for some particular purposes. R. D.

* The burnet's going off in about six years has happened

every year; and so much, that I think of plowing it up next spring. I have been told by many persons, whose veracity I can safely rely on, as they spoke from fact and experience, that in some places the cattle, though ready to starve, will * not eat it. What can be the reason of this, I am at a loss to know. With us, horses, cows, and hogs, are very fond of it: and, for sheep, it is a most excellent pasture; I may add a very healthy one: as I never had one sheep die in that field; though they have been there three months at a time, in the winter, without once removing them.

happened, in other places, where it has been cultivated with most success. But if five years hay, or pasture, with a product equal, taken the whole year, to that of good grass meadows, can be obtained from indifferent land at so small an expence as that of sowing it with burnet-seed; especially if it be done along with barley, as above-mentioned, in Mr. Jervis's letter, page 78, it is certainly a very advantageous culture. The continuance of it in winter and spring, at which time it is a most valuable food for sheep and cows; together with the effect it is now known to have in conducing to preserve sheep from the rot, are very great additional motives for attending to it. R. D.

* There is no fact better ascertained, than that, in some places, neat cattle, horses, and sheep, all refuse burnet; and in others, eat it readily. The reason of this difference unquestionably lies in the ground; and is yet a mystery. The caution, on this account, intimated in a note, page 77, ought always to be attended to by those who are beginning to cultivate burnet, on land, the quality of which they are ignorant of, as to this point.

The common turnep-cabbage being much recommended as a very hardy plant, that would abide the most severe winter, I thought it worth making some trial of. Accordingly, in March 1767, I sowed an ounce of seed. When the plants had six leaves, they were pricked out; and were transplanted, two feet square, into very rich ground. At Michaelmas, they were fourteen, and some eighteen inches round; and had a very promising appearance. The winter proving very severe, a great number of them rotted * with the frost: and more in proportion than of the common green round turnep.

Mr. Reynolds's turnep-cabbage †, I have a much better opinion of; and am in great hopes, it will turn out the plant we have so

* It is now determined by sufficient facts, that the turnep-cabbage, when cultivated on a drier soil, will stand the most severe winters; but that, in moister places, where it is more succulent and grows larger, it is killed by very keen frosts: It cannot, therefore, be depended on, in such places, for a winter-food for neat cattle or sheep, so well as the turnep-rooted-cabbage or the borcoles, which appear to resist the greatest rigour of season in this country. R. D.

† A particular account of the culture, product, and use of this plant, which was given to the Society by Mr. Reynolds, who first introduced it, is inserted in the first volume of this work: and there are some additional observations in article V. of this volume. Whatever is there said in commendation of this plant is confirmed in the account given by Mr. Jessard of an ample and judicious trial, related in the next article. R. D.

long wanted, and searched after, hitherto, in vain. February 28th, 1769, I sowed a pound of his seed; and, on the 26th of May, transplanted ten thousand plants, on a very poor chalky bank, in a situation directly opposite the south. From the day they were planted, there was little or no rain for eight weeks: and, though I expected to see them all scorched up, they continued healthy and flourishing; some small plants excepted. At the same time, I set about one thousand of these forward-sown plants upon a hungry gravel, in the center of which had been an old cucumber-bed: and, though the dung was carried clear off, yet the plants on that spot were so very exuberant and rank, that they wanted room; though they were full two feet square distant from each other; and their size and weight were four times greater than the adjoining plants. From hence, it is very evident, that though they will grow very * well on poor land, if well tilled, yet dung will not be thrown away upon them, any more

* The growing well, and affording a good crop, on indifferent soil of several kinds, is agreeable to what has been advanced by Mr. Reynolds. But in his trial he did not find that manure was of much effect: which variation from what Mr. Lambe found here, must be imputed, to some accidental circumstances. This property of flourishing in a poor soil, together with the standing either great moisture or frost, are the two qualities, that render this plant extremely valuable. But its solid consistence, and oily nutritive succulence, are great additional recommendations. R. D.

than other plants. Though the long drought on these plants, undoubtedly, must have very much retarded the growth of them: yet, when the rain did fall, they came on beyond all expectation. By the latter end of August, they entirely covered the ground: and, upon the whole, the plantation is the best in my neighbourhood. This little crop, I have fed off with cows, sheep, and hogs. They all devour them most greedily: and the hogs, in particular, rooted up the bottoms, as clean as if they had been dug up with a fork.

P. S. Last summer, I was desired by your late secretary, the very worthy Dr. Templeman, to send the Society some account of what experiments, I had made on the abovementioned grasses and turneps: which, he had heard, I had cultivated. According to his desire, I drew up this detail to be laid before the Society: and as, by his much lamented death, I have not the assistance of his mediation, I hope you will candidly accept this small tribute due to your most excellent institution.

November 30, 1769.

ARTICLE

ARTICLE XVIII.

OBSERVATIONS *on the Culture, Product, and Use in feeding Sheep, of the Turnep-rooted-Cabbage communicated in Three Letters to the Society for the Encouragement of Arts, Manufactures, and Commerce; and inserted at their Request.*

To Robert Dossie, Esq.

SIR,

THE Society for the Encouragement of Arts, Manufactures, and Commerce, directed me to deliver to you Mr. JESSARD's Three Letters on the Turnep-rooted-Cabbage, in order to their being inserted in the Memoirs of Agriculture, if you think proper.

I am your very humble servant,

SAMUEL MORE, sec.

To the Society for the Encouragement of
Arts, Manufactureries, and Commerce.

GENTLEMEN,

I Shall make no apology for the introduction of this Letter, it being designed for the use of the public: and therefore, I chuse, it should pass through the hands of the honourable Society of Arts, &c. for the benefit of the community, in case they approve of it.

Some ill reports have been raised, either through ignorance or design, or both, tending to depreciate the plant called Turnep-rooted-Cabbage, lately introduced by Mr. John Reynolds * that may not only lessen his character, but also prove detrimental to the public: inasmuch, as many persons well inclined to propagate this root, may be prevented from making trials of it.—Now, in order to remove these prejudices, or false aspersions; and convince the public, in the most satisfactory manner, that the very reverse is most true; I have sent a specimen of these valuable roots for the inspection of the Society:—by which they will see how ill-grounded those prejudices and aspersions are.—The roots are a sample of the produce of about three acres raised, by me, last May,

* See vol. I. articles IX. and X. and article V. of this volume.

from

from seed had of Mr. Reynolds; and most certainly do honour to him for the introduction of this kind of turnep: and, notwithstanding they are not yet come to perfection, I make no doubt they will merit the approbation of every individual concerned in agriculture. For I can safely affirm, the produce to be no less than forty tons per acre. I am so well pleased with their growth, and my crop, that I hope never to be without a good stock of them for the future: seeing they are likely to produce such abundance of good food for cattle; and that at a time generally most wanted: I mean in the spring; when they are a good substitute for the common turnep after it is gone.

It is needless to add more *, when the plants are before you, Gentlemen. Every inspector must see their great utility to the farmer, and land-holder. I think myself

* The roots were laid before a committee of the Society for their inspection, and judgment: and had so promising an appearance, that Mr. Jessard seemed well-warranted in what he had said of this kind of turnep. The committee were so sensible of it, that they desired Mr. Box, their assistant secretary, to write to Mr. Jessard, to request of him to communicate the particulars of the culture, application of the roots to feeding his sheep, or any other material circumstances relative to his crop. In consequence of which he sent the following letter. R. D.

happy,

happy, by having it in my power to send you these precious roots.—My best wishes attend the the Society.

I am,

Gentlemen, with all due respect,
your most obedient humble servant,

Minster, in the Isle of Thanet,
Kent, 8th December, 1769.

HENRY JESSARD.

P. S. I have this day shipped the roots per Capt. George Covell, a Margate hoyman.—I presume you may receive them about Tuesday next.

To Mr. GEORGE BOX.

SIR,

I AM glad to find the honourable Society of Arts, &c. have taken such agreeable notice of my letter to them, about the roots sent, as to desire to know how, and in what manner the culture and management were performed, together with other circumstances attending thereon.

In obedience to their request, the short is, this.—Part of my field was manured with dung, and mould, mixed together; and laid on in the common manner: about forty loads per acre. The other part was well
I folded

folded over with sheeps dung, in order to see the effects of both. Little difference appears, however, between the two. But I give the preference to the dunged part at present.

This land had five ploughings from Michaelmas, 1768, to the month of May, 1769. Each of them was performed between nine and ten inches in depth : which is as deep as my land would bear ploughing.

The seed was sown the 13th of May : and the plants were set out, on the 27th, and 28th of June, in two foot intervals : allowing about seventy plants to one perch. They were hand-hoed in the month of August. The soil is a dry gentle loam ; and had a wheat-crop the preceding year. I ascertain the growth from a considerable number of plants indifferently chosen from the whole field. Whereby I am fully assured the weight is no less than forty tons per acre, including the whole plant taken in its natural state. A fair way of computing : as the stock eat both root and branch without distinction, the whole ought to be accounted for *.—So extraordinary as this may appear to some, yet I make no doubt, they will

* It is in answer to two questions proposed to him, by the committee, that Mr. Jessard mentions these particulars here. These two questions were, *On what foundation he had formed his computation of the product per acre?* And, *Whether he included both the herbage and the roots in the forty ton?* R. D.

still increase; and become a much greater burden before they are spent. For I am confident, those raised by Mr. John Reynolds have grown much in the spring-months, of February, March, and April; so that I have just reason to conclude, those of my growths will do the like. Though, indeed, at that time, I shall be better enabled, by experience, to give a more particular account of this choice plant: which I shall with great pleasure do, if requested by the honourable Society.

But, Gentlemen, be assured nothing herein is the least exaggerated beyond the truth. For I have no motive whatever in view but serving the public in the case before us, should they condescend to take cognizance of what has been, and now is still farther going to be laid before them, concerning the utility of this matter, than which nothing is more plain and convincing, viz. that this is a noble plant, and highly worthy of our reception. Whatever some few individuals may mistakenly think to the contrary, no mortal can dispute it with reason.

It is much to be wished the people, chiefly concerned in agriculture, would lay aside their obstinate inveterate prejudices, the great evil, and bar to all improvements;—and be convinced from trials, for the good of the community.

My

My dutiful respects attend the Gentlemen of the Society,—and I am,

S I R,

Your very humble servant,

Minster, 2d January, 1770.

HENRY JESSARD.

To the honourable Society of Arts, &c.
assembled in the Strand, London.

My Lords and Gentlemen,

IN obedience to your last *, I have the pleasure of saying my new turneps turned out a noble crop both in quantity and quality.—As to the first, I find they have increased in weight upon a common average, within the months of February, March, and April, to the amount of four tons per acre; so that the whole product, taken altogether by a just calculation, is found to be full forty-four tons per acre, on an average one with another.

* On the consideration of the foregoing letter, the Society directed a second letter to be written to Mr. Jessard, to desire he would preserve a part of the crop till towards the end of the spring: and to inform them of the state, and growth of the plants, till that period. This is an answer, from Mr. Jessard to their inquiry on that head; and on the estimated value of the crop, according to the manner in which he consumed it. R. D.

Indeed,

Indeed, I know nothing equal to these roots at this season : especially, as it is a backward spring, and there is a great want of meat.—I have found them of signal service to my sheep, being fine substantial food ; much superior to common turneps or coleworts : and what is still more valuable, they may be had when these last-mentioned cannot. They are therefore highly worthy our esteem, from their coming in at a pinch of need ; and consequently ought to be propagated for spring-food by every individual concerned in breeding, and feeding of cattle, that has it in his power.

I come now, Gentlemen, to speak of the way and manner of spending the crop.—It has been before said, the whole was about three acres : and that the product on each acre was forty-four tons. I repeat this, to shew, at one view, what stock these roots maintained. It was three hundred and ninety sheep from the 9th day of April to the 28th day of the same month, both inclusive, on the first two acres. For this purpose, a field was pitched, of an oblong form : which, by a subdivision, became two squares. In the front, were those designed for fattening, both ewes and wethers. In the rear, I placed my lean sheep, in order to eat the remains left by those in front. And thus all was spent, without the least loss.—

The

The fold was moved upon fresh plants every other day : and those plants were dug up before the entrance of the sheep.—This method prevents their food from being stench'd by their dung and urine. Here they lived in the day-time for twenty days ; but were taken out of nights into a rough pasture for shelter only. The weather being often times wet and cold ; and the lands, where the roots grew, being very bleak and open ; this became necessary to prevent the ground's being poached : and lying wet would have been very injurious to the sheep.—The weather being more favourable, the 29th of April, I confined three hundred and fifty sheep within the field, day and night, whilst the last acre was spending. This kept them exceeding well twelve days, till the whole crop was near spent, the 10th of May.—The result was, all thrive well and liked their entertainment ; not one drooped in the least. The whole flock, of three hundred and ninety sheep are much improved : and that too *without any fodder*, at a time of great scarcity. These are very agreeable circumstances to the husbandman : and, I think, strictly worthy of his attention.

Henceforth let no man complain for want of spring-food for his stock : since it is to be obtained in abundance from the culture of *Reynolds's Turnep* *. For so, I beg leave

* It is proper, along with these recommendations of the turnep-rooted cabbage, given in consequence of
Mr.

to call it: seeing he has taught us the use of it. And, indeed, a very great acquisition it certainly is to the land-holder, whatever malice may invent, or ignorance suggest to the contrary.

It may, perhaps, be expected I should make an estimate of the value of the crop. But this I shall forbear doing myself; and let others judge of it: yet this I know, numbers would gladly have given four-pence a head, per week, at this hungry time, for such keeping as my sheep had.

Mr. Jeffard's, and Mr. Reynolds's success, to inculcate a caution, not to attempt a great quantity till some experience has been had of the soil, on which it is to be raised. In several instances, where it has been sown by persons of the most consummate skill in husbandry; and where the method described by Mr. Reynolds has been pursued; it has either produced only a small turnep; or in others has sent down a long root with little or no appearance of a bunch or tuber. This variation should be guarded against by a previous trial: but should not be a discouragement to the making such trial. For where this plant will flourish, as it has done in Mr. Jeffard's three acres, it will certainly be a great advantage to have the means of raising a crop, that, besides the great benefit of providing for sheep at the season when all other green food fails, will produce, according to Mr. Jeffard's account of the profit, near twenty pounds per acre, when all expences are paid; and leave the land in excellent condition for a succeeding crop of wheat; or to receive common turneps immediately, and barley the next spring, without any further dressing. R. D.

I hope

I hope this account will be satisfactory to the Society, and sufficiently convince the people of the utility of this root.

I am, my Lords and Gentlemen,

with all due respect,

your most obedient humble servant,

Minster the 14th
of May, 1770.

HENRY JESSARD.

ARTICLE XIX.

An Account of a profitable Method of sowing Turneps in the Intervals of a Crop of Beans : communicated to the Society for the Encouragement of Arts, Manufactures, and Commerce, in Two Letters from Mr. PHILPOT CHAMBERS; and inserted at their Request.

To ROBERT DOSSIE, Esq.

S I R,

THE Society for the Encouragement of Arts, Manufactures, and Commerce, have directed me to deliver Two Letters of Mr. PHILPOT CHAMBERS on the sowing Turneps with Beans, in order to their being inserted in the Memoirs of Agriculture, if you think proper.

I am your very humble Servant,

SAMUEL MORE, sec.

To

To Dr. *Templeman*.

WORTHY SIR,

Deal, Nov. 5, 1769.

I HAVING tried an experiment in the farming way, and found it answer my expectation, I hope it may, also, be found of benefit to the the public; and therefore beg you will be so good as to communicate the following lines, containing an account of it, to the Society of Gentlemen, who encourage the Arts, &c. for their approbation.

After trials, made in several years, and by different methods, in endeavouring to raise a crop of turneps, without the loss of a crop of corn, or putting my land out of the regular tilths, I have, at last obtained, in the following manner, the thing, which I had aimed at so long.

In the beginning of March, 1768, I put a piece of land of seven acres in with long-podded beans; which I both horse-hoed, and hand-hoed, as usual, in the summer-time. The 25th of July following, I sowed turneps amongst them; and hoed the beans: which answered two ends, to clear the beans of weeds, and to heal the turnep-feed. As soon as as the turneps were up, and out of danger of the fly eating them, I pulled my seven acres of beans; which produced forty-six quarters. When I had bound my beans, and set them at an end, I hoed my turneps out. These turneps fatted me thirteen

A a 2

oxen

oxen : which together weighed 1059 stone 7 lb. What turneps, the oxen had spoiled, kept my milk-cows the whole time the oxen were fattening.—By the 11th of February, 1769, I had cleared my ground of the turneps, except the very small ones ; which I eat off, by turning in a large flock of sheep, for four or five days : and then the ground was as clean as a summer-fallow. — I ploughed it in directly ; and sowed it with wheat, the 18th and 20th of the same month : which corn produced me one thousand, four hundred, and twenty large sheafs of fine wheat.

Being unwilling to communicate my first trial of raising a crop of turneps, without any loss, and choosing rather to make a second experiment of the same thing, and by the foregoing method, I found it to answer my expectation. For, on the 8th of July last, I sowed seven acres of turneps amongst my beans, as I had done before ; and proceeded in the same manner : which turneps proved preferable to any in the neighbourhood, that was sown on a summer-fallow. In short, they were so good, that I sold them to the gardeners to supply both Deal and Dover with turneps for the table. My land was cleaned the 28th of last month : and now I have sown it with wheat.

The time of sowing the turneps, must be left to the discretion of the farmer ; sooner, or later, as he sees the harvest approach.—

About three weeks before the beans are fit to pull, is a good time for it. Then the turneps will be strong, and out of danger of the fly. Though I never knew any turneps eaten by the fly, which were sown amongst beans. The sooner they are hoed out, after the beans are pulled, the better will be your crop. This I know by experience.

It is very plain, that the crops of turneps, sown as above, though very valuable, are all gain. As the expence in hoeing them out, is not more than the expence of clearing the ground, after the harvest, in order to prepare it, for the sowing of wheat.

Thus seeing its utility, I intend for the future, (finding, by the two former experiments, the advantage gained,) to sow turneps among one third part of my beans every year. So that, by this means, my land will be turneped only once in nine years throughout : which land, with good husbandry, will, doubtless, bear as good corn without any more manurement, as if turneps had not been sown.

Now, Sir, having communicated the two experiments to the Gentlemen, with my remarks on them, and my advice with regard to the time and season to proceed in, I leave therest to their most serious consideration, and am, Sir, with respect,

your humble servant,

PHILPOT CHAMBERS.

The Committee, to whom the above letter was referred, sent the following queries * to Mr. Chambers.

1. What number of the sheaves mentioned in his letter will produce a quarter of wheat, when threshed? and what crops of wheat, the same kind of land will yield in moderate seasons, when sown in the autumn?

2. In what manner his beans were sown with respect to the number of rows, and the space of the intervals?

3. At what he rates the value of fattening the oxen and feeding the cows and sheep, per head?

4. What he means by the expression † healed the turnep-seed?

* The Committee were well apprised, that this practice of sowing turneps in the intervals of beans, though new in the neighbourhood of Mr. Chambers, was in use in some few particular places elsewhere; but confined to those places, and far from generally known. They were sensible, likewise, as well from the facts so fairly and distinctly stated by Mr. Chambers in his account, as from other observations, that this mode of culture was beneficial; and that, consequently, it might be of service to the public to make the knowledge of it more extensive, by the publication of this account. But, in order to render the communication more satisfactory and effectual, they thought it would be proper to procure a further explanation of some points from Mr. Chambers. The queries here specified, were, therefore, sent to him, with that view, in a letter from Mr. Box, the assistant secretary: and the following letter was written in answer to them.

† The word healed, is used by the farmers in some particular places. It was well known to several gentlemen

at

5. Whether he thinks this method of sowing the turneps among beans of particular advantage against the fly?

To Mr. Box, Assistant-secretary, to the Society for the Encouragement of Arts, Manufactures, and Commerce.

S I R,

Deal, December 4, 1769.

THIS comes, with my compliments to the Gentlemen of the Society and yourself, to acquaint you, I received your letter, bearing date the 28th of last month, by order of the Society; and, according to that, will give the Gentlemen the best account I can, in answer to their questions: which is as follows:

1st. As to the quantity of wheat *, mentioned in yours. — I have already threshed

at the committee: but, being a local term, they thought an explanation of it from Mr. Chambers might render his meaning more certainly intelligible, when his account should be published, to those who live in places where that word is not adopted: and, therefore, they made it the subject of one of the queries.

* Mr. Chambers, in his letter to the Society, gave the product of his crop of wheat in the number of the sheaves, and not in the measure of the grain: which the committee presumed to be owing to his not having threshed the corn at the time he wrote; being only the fifth of November. But the Society having, with success even beyond their expectation, offered a premium that year for the cultivation of wheat in the spring, in consequence of the impediment, the wet weather of the preceding autumn had given to sowing it as usual at that season,

about fifty-four sheaves : which yield a quarter * of exceeding good wheat ; and the growth of wheat upon the same land for twenty years past, on an average, has not produced more than the above increase, when sown in autumn.

season, the committee thought it material, as well in order to obtain information with respect to the product of wheat sown in the spring, in a general view, as for the more clear illustrations of the facts in Mr. Chambers's account, to know the real quantity of grain afforded by his seven acres, which had been sown in the spring, after being previously subjected to the crop of beans and turneps.

* According to the proportion of the sheaves of the corn to quarters of the grain, as here ascertained, Mr. Chambers's crop on the whole seven acres, which amounted to one thousand four hundred and twenty-seven sheaves, must, throwing out fractions, have afforded twenty-six quarters, three bushels of grain ; which is nearly three quarters six bushels, per acre. So good a crop shews, that the prejudice against sowing wheat in the spring, where there is any collateral reason for it, has been taken up too strongly in general : and that the benefit of a winter-crop need not be rejected, when the land is too strong for barley, and the sowing of other spring-grain is not expedient : as wheat may be sown, after such a crop, with equal advantage in some seasons as that sown in autumn ; and, in most, without such difference as would not be greatly overballanced by the profits of the winter-crop. — It is not from the single fact of Mr. Chambers's crop, I presume to say here, that, in favourable seasons, wheat sown in the spring will yield an equal product with that sown on the same kind of land in autumn. For I saw the like happen in a number of instances of those, who sowed wheat the same spring : and the grain, likewise, was well ripened ; and produced the quantity of good flour. How far this depended on the peculiarities of that season is not clear. The greater length

2d. In respect to sowing the beans, I make ten rows to the rood: the intervals between them being $19 \frac{3}{10}$ inches, which is the properest distance, I have hitherto discovered.

3d. In respect to fattening the thirteen oxen, the profit, which accrued from each ox, whilst feeding upon the turneps, is about two pounds four shillings, as near as I can possibly judge †. As I fed them some time upon grass, before they eat turneps, I cannot speak with exactness. Only this, I can say, that I have, by feeding oxen on them, made four pounds, per acre, of turneps sown amongst the beans, without the loss of a crop of corn; but not without putting my

length of time for the corn to tiller, seems to be a reason for an increase of the product of grain. How far this goes; or in what manner it may be counteracted by other principles; remains to be determined by trials. But it is certain, from what occurred last year, that the common opinions respecting the disadvantages of sowing wheat in the spring were erroneous in a great degree.

† The value of the turneps, according to what is here stated, was sixteen pounds fourteen shillings; which is at the rate of two pounds seven shillings and eightpence half-penny, per acre. It evidently appears to be a very considerable crop: and, if we take along with the profit, the security of not losing the turnep by the fly; and that the whole is gained without any additional expence but that of the seed and sowing; this mode of culture must appear very beneficial: and as it increases the stock of provisions afforded the same year from the same land, it must be deemed very advantageous to the public, as well as the farmer.

land

land out of the regular *tilths*. But this was before I arrived at such perfection as not to lose my wheat *tilths*; nor put my land out of the regular *tilths*.

As for the four milk-cows, that eat the turneps, which the oxen spoiled, I do not value that offal, at more than two pounds ten shillings.

My principal reason for turning in a large flock of sheep for four or five days, was for them to eat the small turneps, in order that none might grow amongst the wheat. The value of their keeping is not more than twenty shillings.

4th. As to what I meant by *healing* the turnep-seed. It is a common term amongst the farmers to say, *heal* the seed; or, is the seed well healed? For, when I sowed turneps amongst my beans, the hand-hoeing of my beans covered the turnep-seed with earth, and laid it both regular and smooth.

5th. This method of sowing turneps among beans is of particular advantage against the fly most certainly. As the young plants, by that method are shaded * from the heat of the sun, by the interposition of the beans.

* It is not to the shading by the beans only, the escape of the turneps from the fly is in this case to be imputed. The earliness of the time of sowing the turneps is known to have a good effect in this crop: and, perhaps, the neighbourhood of the beans themselves may contribute to keep off the fly.

I have,

I have, at this time, a small plot of turneps, that was sown amongst beans in my garden; the seed of which I had from Norfolk. It is of so fine a kind, that the turneps, which are the product of it, are ten and some eleven inches diameter. These turneps I intend to let stand for the increase of seed: being an extremely good sort.

At the same time that I sowed the above plot, I sowed another small plot adjoining upon the fallow ground with some of the same seed, and covered it in the same manner. It was all destroyed by the fly; and, therefore, I think this last example to be a plain demonstration.

According to my abilities, and experience, I have given the Gentlemen, the best account I can; therefore I remain, with respect, the Gentlemen's and your

Most humble servant

PHILPOT CHAMBERS,

ARTICLE

ARTICLE - XX.

OBSERVATIONS *on the* MURRAIN,
or PESTILENTIAL DISEASE OF NEAT
CATTLE;—*the Means of preventing the*
Infection;—and the medicinal Treatment
of the Beasts when seized with it.

AFTER the best methods of breeding and feeding cattle, the next great object of improvement in *pastoral agriculture* is, the preserving them from mortal diseases; but especially from those, which, in consequence of general causes, seize, and carry off great numbers together.—The more lax and tender habit of sheep subjects them constantly, in our country, to such a distemper, called the rot: which seems the result of principles arising from the nature of the soil, and climate; and subsists always in one part or other, though with various degrees of extensiveness according to various circumstances of place, and season. But the *neat cattle*, being of a stronger, and more hardy constitution, are not *ordinarily* disposed, with us, to any disorders, that attack, and destroy great numbers at the same time, and from the effects of the same principle.—There is, however, a disease incidental to the beasts of this kind, which propagating itself by infection; raging at times in most countries of Europe; and carrying

carrying such destruction wherever it comes, that it may be truly deemed a *pestilence* of the cattle; has, in its turn, visited our island; and made us experimentally sensible of its dreadful consequences. It prevails with great malignity, at this time, on the shores of the continent opposite to us: whence some sparks of the contagion have been lately brought and kindled here, in more than one place, as is imagined. Happily a quick extinction followed this introduction of it into our country: but there is the justest ground of apprehension, from these instances, as well as from other circumstances peculiar to the present *, it may be again conveyed to us;

* The prevalence of the contagion of the murrain, at this time, throughout the countries of the United Provinces, whence there seems little hopes it will be soon expelled, renders it extremely liable to be brought over to us, in consequence of the intercourse we have with those countries.—It is, indeed, only under particular circumstances, as will be shewn below, that the cattle, with us, is susceptible of this infection. Because, even when most diffused over our country, it extinguishes intirely of itself in favourable periods, when the general state of animals is healthful: as we have twice experienced in the present century. But the irregularities of the late seasons; and, particularly the great alternations of heat and cold, the continuance of wet weather, and the frequency of easterly winds, all which are injurious to animal strength, and, conspiring in this year, have manifestly weakened both vegetables and animals; have consequently rendered the cattle peculiarly susceptible of this infection, as well as mankind of those contagious distempers to which they are subject. This is not only evident from clear deductions, from demonstrable principles of physiology; but from the fact itself.

and spread through the whole country ; if the greatest care be not exercised to prevent the bringing it over ; and to suppress it immediately, in any particular place, where it may be found to have been brought.

This disease, so fatal to horned beasts, was formerly called, in English, the MURRAIN : but it is now more generally named the CONTAGIOUS DISEASE of Cattle. The name of murrain ought, however, to be resumed : because it is well known there are other infectious distempers of cattle, besides this, which might possibly subsist here at the same time : and the want of a due dis-

itself. There being two, if not three instances, of the contagion of the murrain having taken effect in our island, within the space of a year, in parts the most distant from each other. One was in the south, last autumn : which occasioned the issuing the orders of council, that were then published ; and the notice taken by his majesty, in his speech, at the opening the last session of parliament. Another was far north, in Scotland : where it seems, also, to be established on good authority, that some beasts were actually seized with this disease. The third, but not equally well vouched and ascertained to be this disorder, was in Northumberland, near Newcastle. — The effects of the contagion in all these places, were confined to a few beasts ; and happily were suppressed in a short time. But it is to be apprehended, that, from the increased disposition of the cattle to receive it, in consequence of the unfavourable circumstances of season, if the infection were again introduced, we have the most mischievous consequences to dread from it : and whoever will examine well the present orders and regulations of the government, made to hinder the spreading of the contagion, will find we can have very little dependance on them for our security against this momentous evil, as they now stand.

tion of name would therefore occasion confusion in the communications, and deliberations requisite to the measures for suppressing them *. — The destructive effects of the murrain are but too well known from the havock made during its continuance here, with greater or less violence, for fifteen or sixteen years. But the true nature of the disease is very little understood: and even the appearances, and obvious symptoms, are known, in any distinct manner, only to very few.—Considered, therefore, either in the view of promoting the interests of agriculture, or providing the means of security against a very momentous national evil, it is a matter of the highest importance to investigate the causes of this distemper,—the manner in which its contagion acts, and may be conveyed, — the symptomatic appearances it exhibits; — and the mode and success of the trials already made to prevent the infection, or to cure the disease; and thence to deduce the best methods of hin-

* The having a particular name for the pestilential disease of cattle here treated of is the more necessary, because another contagious malady of cattle is said to have broken out lately in Italy, and is called the *cancer volant*. We have as yet no perspicuous account of the symptoms of that malady. But from the name, if it have any allusion at all to the similitude betwixt that disease and cancers, we must conclude it to be very different from the murrain: and as this new disease may spread itself over the other countries of Europe, and possibly reach us, it is particularly proper at present to keep the names distinct.

dering the introduction of the contagion into places free from it, or the dispersion of it more extensively when introduced ; and of saving, by medicinal aid, as many of the cattle when really infected, as is practicable with due advantage to the owner.

It is the more necessary, that all material information, respecting this contagious disease of cattle, should be collected, and some proper plan of proceeding for its prevention and cure, thence formed, and published, because nothing of this kind, so perfect as to be of any practical use, has been hitherto given to the public in any language.

Many voluntary writers, in different periods and countries, have, indeed, published treatises on this subject ; and some professors of physic, and academic bodies have been called upon, by the authority of government in several states, to deliver their opinions on it. But little success as to practical utility has resulted from the labours of either. As to medicinal means, either for the prevention of infection, or cure of the distemper, nothing offered in these works, has been carried into general practice any where : nothing offered in them, for reasons we shall have occasion to touch on below, having been found of actual benefit, at least in the way there proposed : and as to other preventive means of excluding the contagion

contagion from places free from it, or the hindering its spreading when it has found admission, some measures very proper in their nature have been adopted both with us and elsewhere ; but not so effectually as to the manner, as to be accounted a full security against the danger, to which, as was above intimated, some unfavourable circumstances expose us, at present, in an extraordinary degree.—With relation to the description of this disease, there are more than one work, which have considerable merit with learned readers. Dr. Layard's treatise, published in our own country, and Professor Camper's published in Holland, both contain true accounts of the symptoms, and appearances : but they are delivered in such technical terms, and manner, as render them not clearly intelligible to any but persons acquainted with medical subjects ; and, consequently, not practically useful to owners of cattle in general ; nor to others, who may have concern with the cure, or prevention of the murrain. As to the theoretic observations on the nature, and process of this disease, there is nothing hitherto exhibited to the public, but references of it to the school hypotheses of the sect of each writer ; or reasonings from single particulars, in which the conclusions are no way sufficiently warranted by the premises ; nor correspondent, in most points, with the general *phenomena*.

Induced, by the importance of the subject ; together with the apparent want of a more familiar description of the appearances of this distemper of horned cattle, and just account of its nature, as well as of the means of prevention and cure, as they may be thence deduced ; I have here attempted to supply this deficiency * as far as the brevity, prescribed me by the want of greater room in this volume, would admit. The other parts may be enlarged on to advantage, and are intended to be more amply discussed in a treatise published on this subject solely : but the description of the appearances of the disease, which is at present by far the most essential of all other commu-

* While the disease was rife in this country, I endeavoured to amass all the information in my reach, respecting its nature, appearances, and cure, as well from immediate observation, as books. Since that time, I have extended the knowledge I then collected, by the communications of several able professors in the countries where this disease has more lately prevailed ; and, particularly, by a correspondence with an ingenious physician in Holland, who has in a particular manner applied himself to the consideration of this subject ; for which there is, at present, but too great opportunity in his neighbourhood. I presume myself thence able, not only to give a more succinct and clear account of this disease ; but also to furnish some new lights, which may lead to the obtaining a more effectual method of medicinal treatment of the diseased beasts : and, likewise, to the supplying those defects, and removing those difficulties, which render the provisions made by the government against the introduction of the contagion into our country of less avail at present.

communications

nications respecting it, not requiring more compass than can be afforded to it, is fully given here.

I shall, therefore, first offer some general account of the murrain, with respect to the manner and periods of its former appearance here, and in other places;—the general effects of it;—the susceptibility of the cattle, as to its infection;—the conveyance of the contagion;—and the means hitherto proposed for the prevention of the infection, and the cure of the distemper. I shall next describe the true symptoms, and minute appearances of it; and, as far as can be inferred from them and other facts respecting it, explain the true nature of the disease; and point out the indications of cure. To this, I shall afterwards, subjoin some observations on the best method of medicinal treatment for saving such of the cattle as are curable; and the proper means of rendering effectual the plan of regulations ordained by the government for the prevention of the contagion.

Accounts of contagious diseases of neat cattle are found in the writings of the ancients; and in those of most of the periods betwixt them and us *, in which the state of letters has

* Among the authors, who have mentioned, or treated of the contagious diseases of cattle, in the earlier times, the principal are Aristotle, M. Portius Cato, Plutarch, Virgil, Livy, and Columella. Among those of the later period are, Vegetius, Eginardus, Gesner, Aldrovandus, Fracastorius, Ubbo Emmius, and Outhoff. Since the year 1711, that this disease has run through all the countries of Eu

afforded an opportunity to transmit to us the passages of the times. Several of these accounts do not specify the symptoms attending on the diseases. But some describe them, though with a diversity of circumstances in some from others; and with a variation in all from the appearances now found in the murrain. Such variations of the same disease, at different times, and in different places, happen, however, in other instances: and it is, therefore, not easy to determine whether the contagious distempers of the cattle mentioned in the earlier writers, were all, or any of them, really the murrain, or not. If, nevertheless, it be a matter of difficulty to ascertain this point, it is happily of as little consequence: because, as we shall see below, the means related to be used for the prevention or cure of those diseases, except the methods of hindering the conveyance of the infection, which are equally proper in all such cases, appear trivial, and inefficacious: and, therefore, no practical advantage can be drawn from

rope, there are great numbers of Dutch, German, Danish, French, and English writers on it, either in detached essays, or pieces inserted in journals, and periodical works. The chief of these are Lancisi, Ramazini, Perrault, Pujerus, Blasius, Bates, Blondel, Goeliche, Ranold, Brucknerus, Engelman, Nofeman, Tak, Kroot, Manchart, Brocklesby, Mortimer, Buffon, Grashuys, Marquis De Courtivron, Swenke, Layard, Camper, and Monchy.

settling

settling these doubts respecting the identity of the disease, as might have been, had these means proved to be more effectual.

The first clear traces, we have of the later introduction of the murrain into Europe, commence in the year 1710, or 1711: at which time there are authentic accounts, that it was observed in Hungary. Whether it was brought thither from other countries, most probably further to the south-east; or, if not, how it was originally generated there; we have no lights that lead to any certain knowledge. But it was conveyed thence into Dalmatia; and propagated, through that country, to the neighbourhood of Padua: whence it spread over the whole of the Venetian state. It was soon afterwards, disseminated through the whole of Italy; and passed, in 1713, through the Tyrolese into Germany. Whence it communicated itself to almost every other part of Europe, as far north as Denmark and Sweden; introducing itself, also, about that time, into Great Britain. After this, in consequence of more favourable seasons, the contagion abated, by degrees, in all the places where it had prevailed: and, in about nine years, the infection seemed to be exterminated in most of them. There is reason to believe, notwithstanding, that some lurking remains kept their ground in parts where the relaxation of moist air, and the debilitating effects of

putrid vapours, rendered the cattle more susceptible of all contagion. For, in the beginning of the late king's reign, the disease revived here to such a degree, as to give occasion to the government, to make some regulations for the suppression of it: tho', after a short time, the infection again seemed to have been extinguished. It, also, appears to have shewn itself in some parts of Germany even to the year 1730.

In the year 1740, or 1741, this disease again broke out in the south-eastern parts of Europe; and made its progress through the same countries, as in its former course after 1710.

It was brought hither, in 1744 or 1745, from Holland, as is believed; and made great devastation of the cattle for several years: after which it declined considerably; but took fresh vigour in 1756; and continued to rage with considerable violence for some time. It then abated gradually: and, as far as appears, the infection at length was wholly lost. As, for a number of years, we had not the least signs of it, before the autumn of the last year, and since: when it is believed to have broken out afresh in two or three places of the island: though not, as there is reason to conclude, from any relicks of the former, but the introduction of a new contagion brought from other countries.

In the mean time, though we have been free from the murrain for a number of years: yet it has, during that period, visited other places. Denmark and Jutland, in particular, felt it in 1769, with greater severity than has been ever known elsewhere.—The United Provinces have undergone a yet harder fate, from some disadvantageous circumstances in the temperature of their climate. For, since its first introduction, in 1741, it has never intirely left them; but maintained its ground, though with various degrees of violence at different times: and, at present, it makes great ravage in the parts of those countries where cattle most abound.

These later invasions of several parts of Europe, by the murrain, have furnished the opportunity of making the following general observations on its effects, and consequences

It is to be first remarked that as the infection of this disease, prevails only at particular times, any where; and acts with greater violence at some times, and in some places, than others, according to the preceding view of its migration; so it affects only part of the cattle any where; and those with various degrees of malignancy. This leads us to explore in what this difference of the cattle's being susceptible of the infection, or exempt from its effects when exposed to it, may lie. On examination of this matter it will appear, that where the infection

does not before subsist, it never comes, but after some general cause has weakened the habit of the beasts in general : such as very severe cold ;—long continued want of a sufficient quantity of wholesome food ;—repeated alternations of heat and cold in the weather ;—moist air, replete with putrid vapours ; — a long continuance of easterly winds ;—or, what is more frequent, a combination of two or more of these causes together.—Thus we find this contagion invading every part of Europe after the year 1711, when the season had been so inclement the year before, as to destroy a great part of the sheep in England ; and again in 1741, as mentioned above, after a very intense frost, which lasted from December to April ; and, by the rigour of cold, and scarcity of fodder, had reduced the cattle in general to a debilitated state : which was still aggravated by the almost constant easterly winds that blew the summer and autumn following. After the abatement of it in more clement seasons, which followed that period, we find the disease resuming its force again in various places, since that time, by similar accidents. We see, also, that, from the same principles, it has long maintained its ground in countries where moist air, and vapour of stagnated water, dispose to agues and other diseases, that come from the laxity of the fibres : which disposition is equally produced,

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by

by these causes, in the brute and human species. While, on the other hand, it has been extinguished in places, where a drier and purer air gives robustness, and vigour of constitution to the animals. It has been observed, also, that the infection, when it has abated during the summer or winter, has generally resumed fresh vigour in the spring and autumn, when the alternations of heat and cold have disordered and weakened the beasts.

The same principle, with respect to the cause of the prevalence of the contagion, holds good, as to the particular beasts, which are seized with the disease, or escape the contagion when exposed to it. For we see, in all cases, it is the weaker, which are attacked by it; and the stronger, which remain free from it.—It is ascertained by a very sufficient basis of remark on facts, that the beasts of a black, dark or red colour, either wholly or in mixture, are less subject to the infection, than those which are white, or of a light mixture of colours: and the concurrent observation of all times has established the belief, that this difference of colour is an indication of the greater, or less degree of natural strength of the beast, as well in neat cattle, as horses. It is equally certain, that bulls are less subject to the infection of this disease than oxen; oxen than cows; cows not pregnant than those which are;

are ; and, among all these, such beasts as appear naturally of a feebler make, or are debilitated by any accidental suffering.

It is manifest too, from an equal ground of observation, that the same difference in strength and weakness, which renders the cattle more or less susceptible of the infection, makes them more or less liable to the violence of the effects of it. Those, which are weaker, from any of the above causes, have more aggravated symptoms, and more frequently die of the disease, in proportion to the degree of such causes.

It results, therefore, from these circumstances, that though infection conveyed from some beast diseased with it, is the efficient cause of the murrain in cattle, yet there is a predisponent cause, or particular state of the subject, absolutely necessary to its acting or taking effect : and this predisponent cause is, the condition of the beast with respect to weakness of habit, or relaxation. It appears also, that this weak state of the beast may arise from general causes, either of an epidemic nature, affecting whole regions, such as inclemency, of season or scarcity of wholesome food ; of an endemic nature, affecting only particular places or countries, such as dampness of the air, or abundance of putrid vapours : and that it may be produced, also, from some particular cause regarding the individual only ; such as original weakness of constitution,

constitution, pregnancy, or debility occasioned by some accidental suffering.

The susceptibility of the infection, and the predisposition to be more violently affected by it, in consequence of the weakness of the habit, are neither peculiar to cattle, nor to this disease. It is evident, from what offers in a very extensive field of observation, that both mankind and brutes are liable to the attacks of most contagious disorders in proportion to their defect of strength. Even were it not so well verified by notorious facts, a theoretic proof might be drawn from incontestible principles of physiology; and from the constant effects of medicines administered in such cases. But this is too wide a range of subject to be entered on here; and would, besides, require a previous acquaintance with medicinal science in order to its being understood. That beasts are liable to take the infection of the murrain, and suffer more from it, in proportion to their weakness, is sufficiently obvious from just remarks on the subject itself: and it is very necessary to be understood and taken into consideration in all practical disquisitions on that disease; because it constitutes a principle, which admits of two very useful applications. It not only affords the means of prognosticating, when great numbers, or single particulars, will be seized with the disease, if exposed to the contagion; and consequently,

consequently, supplies the proper notice and warning for the use of preventive methods; but it furnishes, likewise, the true indication of cure; and points out what the regimen should be, that will counteract the disease.

The manner in which the contagion may be conveyed, is likewise, a matter of great moment in the consideration of the murrain, with a view to the preventing its injurious effects.

The observations already made on facts have not set every thing relating to it in a clear and decisive light. There are some opinions respecting it, in which all agree; because they are supported by evident instances: but there are others, which, though they have the sanction of common assent, may yet be disputed on very just grounds. It is unquestionably certain, that the murrain is communicated by transmission of some contagious matter from beasts, which have that disease, to those which are sound: but that this is done by all the means of communication generally supposed, is not, at present, so manifest a matter.

The effects of inoculation in the murrain, as well as a great number of other palpable facts, render it plain, that the contagious matter may be carried by other bodies, which receive it from the diseased beast; and convey it, by actual contact to the sound. This may be performed
by

by any substance, to which the infecting particles can adhere; but is most likely to happen, through accident, by the mediation of any body, that is of a hairy, woolly, or pilous texture *: because the matter is much less liable to be rubbed or cleansed off from such bodies, than from those which are denser, and have an intire and smooth surface.

But there is another mode of conveyance of the infection; which, though it must be allowed to subsist with regard to some contagious disorders, admits of a doubt with respect to the murrain. This is, the communication of the contagion by *the air*.—It is,

* It has, however, been strangely made a matter of doubt, by some eminent professors in the United Provinces, whether the skin itself of a dead infected beast would impart the contagion: and they have even asserted the negative, in consequence of the result of certain experiments made for the determination of this point. But some fallacious circumstance attended those experiments: as, appears even on the face of the relation. It would, indeed require very strong proofs to gain assent to such an opinion; than which a stranger paradox can scarcely be advanced.—It is evident, the infection is conveyed by other substances; and nothing can be more suited to collect and retain the matter of it than a hairy skin. This matter must, undoubtedly, abound in the skin of the beast which generates it, whether it be evacuated by perspiration, saliva, or any other excretion. Indeed, whatever other bodies convey it, must in general receive it from the skin; which, if it can impart the same to them while the beast is living, must, in common with other bodies, retain it a certain time after the beast is dead.

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in general taken for granted, that the air is the chief vehicle of the contagion of this disease : and several means of prevention of its action have been instituted on that principle. But there is no clear fact, which in the least proves this notion : and the universal failure of the preventive means founded on it, furnishes arguments against it, as far as any thing at all can be thence inferred. On the other hand, a great number of circumstances seem to evince, that the cattle are never infected, but by an actual conveyance of the contagious matter, by means of contact of a sound beast with one that is diseased ; or with some other body, which receives first the virulent matter from such beast.—There are many instances, where good fences, and other effectual means of exclusion of whatever could bring the infecting matter, have prevented the cattle in particular places from suffering by the contagion, though surrounded on every side by numbers of beasts seized with the disease. In some of these places, the cattle have escaped to the last. In others, after a time, they have taken the infection, in consequence of known accidents, which occasioned the introduction of the contagion, from the actual conveyance of it by somewhat, that had received the virulent matter from a diseased beast. — Where the neighbouring infected cattle were, in these instances, all
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on *one* side the place, in which those that escaped were confined, this exemption of them might be reasonably imputed, as it has been, to the wind blowing continually the contrary way, and carrying off the contagious effluvia, that might have, otherwise, reached them. But this solution of the difficulty cannot hold good, when, as has been frequently the case, the free place, where the cattle escaped, was surrounded by infected beasts on *every* side.—The determination of this point is not merely a speculative object: for it settles the proper nature and limitations of the means to be used for preventing the communication of the infection; and rightly confines them to such as regard the hindering the contact of diseased beasts with the sound, or the exclusion of bodies, which may convey the virulent matter from the one to the other *.

* The opinion, that the infection of the murrain is conveyed by the air, has been adopted, by the writers on this subject successively, in all the different periods since the disease was first known, without any examination of the fact on just ground of proof. It seems to have been received, on the authority of Hippocrates, who said *all diseases were communicated by the air*. But this is a bad foundation for such a notion. For his meaning in this general assertion appears plainly, by other passages, not to be, that all diseases are communicated by contagion transmitted by the air; but that the air has always some share in their original production, or in the reception of them by particular subjects. And even this doctrine is not to be maintained on any demonstrative principles. For we are certain, that there are
contagions,

From the facts, which have appeared respecting the disease, there is reason to infer, that the contagious matter retains its infecting power a considerable time. The contagion is believed, in several instances, from very strong circumstances, to have been conveyed to remote places in bodies transported by sea : as the known intercourse with the countries, whence it was presumed to be brought, palpably suggested, that manner of its introduction ; which could not be otherwise accounted for. Some of the later experiments, with regard to the inoculat-

contagions, of which the infection is not conveyed by the air ; as the venereal disease, elephantiasis, yaws, and itch : and we know so little of the origin of them, that we can by no means presume to say, the air had any part in their first production.

In the elephantiasis, and in most other contagious diseases, it does, indeed, appear, that the air epidemically, or endemically may act as a predisponent cause to the contagion's being received : but there is a great defect of evidence of its being actually a vehicle of the contagion, with relation to most such diseases. Because it is very difficult to prove, in any particular instance, the infection may not have been communicated, by means of some other body, from the deceased to the sound subject. It must, nevertheless, be allowed, that some contagious diseases are transmitted by the air ; but on nice examination of facts, we shall have reason to conclude them much fewer than are generally allowed : and that, perhaps, we have no competent proofs of any case, where the open air has been the vehicle. Though there are many clear cases, where air long confined in close places, or depraved by the respiration of too great a number in the same room, has conveyed the infection of such diseases.

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ing cattle with the disease, shew this fact with greater certainty of proof. The precise limitation of period, in which the infecting matter will keep its power, is not, however, well ascertained by any observations, or trials: but there is room to conclude, that, under some circumstances, it will act at a considerable distance of time from its being generated. We see the variolous matter will communicate the small-pox after many months: and there is no foundation for any doubt of the analogy betwixt the contagion of that, and of the murrain in this particular. But it is a matter of great consequence, that this should be decided by adequate experiments. Because the knowledge of it is of great moment, in judging of the proper means, and regulations, for preventing the introduction of the contagion into places free from it.

The space of time, likewise, betwixt the beasts receiving the infection, and the perceptible effects of it, is not yet precisely settled by accurate observations. But there are well known facts, that give us a considerable degree of information with regard to it. In general, appearances will be found in three or four days: in some few instances, they may not come on till six or seven. We may state the latter time as the utmost period, unless when the beasts are very slightly affected with the disease: and then, where the

symptoms may not be discernible till it be in its most powerful state, ten days may be allowed. If a beast, therefore, suspected to have received the infection, do not shew any signs of it in six or seven days, there will be very little danger of its being seized : and if none appear in ten, it may be taken for granted, that there is no infection in the case.

The time for detaining cattle in any place, to which they have been removed, after their having been exposed to a risk of the infection, in order to prevent their spreading the disease to other parts, may be, therefore, limited to a fortnight. Since there is not the least hazard, after such time, of their being seized with the disease, in consequence of their having been exposed to the contagion so long before.

These are the general facts, and observations, respecting the murrain, which have hitherto presented themselves. It is proper to subjoin, that, as before intimated, this disease has various appearances, symptoms, and degrees of mortality, at different times, and in different places : as the epidemical effects of the seasons, or endemical circumstances of particular countries, have interfered with the natural process of the disease.—In the United Provinces, a profuse *diarrhæa*, or looseness, is a very common symptom ; and generally carries off the beasts by exhaust-

ing their strength: but, where they do recover, it seems to be the critical evacuation, by which the *virus* of the disease is discharged. Eruptions more rarely attend the murrain in that country: though they are not always wanting.—On the contrary, in Great Britain, the looseness feldomer happens; and is mostly a mortal symptom: though, in some few cases, a salutary one. Eruptions occur much more frequently; and are generally the critical deposit of the *virus*, when the beasts recover.—In Denmark, the disease, when it made its furious attack in 1759, was far more violent and mortal than it was ever known in England or Holland; or than it had been when it infested the same places before. The fatal crisis was then very rapid: the beasts dying in two or three days, and some sooner, after they first appeared to be affected. At some periods, remarkable blisters on the tongue are related to have been an early and general symptom of this disease *: they are not

* There is, as was above observed, another contagious disease of the cattle, of which blisters on the tongue seem, from the accounts of it, to be a constant, principal, and characteristic symptom: and proper care, therefore, should be taken to avoid confounding this disease with the murrain, either in reading, or practice. It appears to have been curable, in most subjects, solely by opening the blisters; and is, therefore, evidently of a much less malignant nature than the murrain: in which, as is well known, from many trials, that operation

near so frequent now ; and only found at, or towards the end of the disease. Like variations are, as above intimated, seen in other malignant contagious diseases ; and render an accurate observation of the symptoms, when they break out fresh at a distance of time, necessary to the forming a just description of them, in order to the distinguishing them, with certainty from others which are similar.

As the mortality of cattle occasioned by the murrain has been a very great evil to many countries, means of the prevention, or cure of it, have been earnestly sought after by great numbers of physicians, and others. But this research has been made with very little success any where, either with regard to the interest of the proprietors of the cattle, or benefit to the public * ; except what

would be of very little avail. This circumstance alone would give a sufficient criterion for distinguishing the one from the other.

* The enumerating the various methods hitherto tried, for the prevention or cure of the murrain, though they were attended with so little success, may yet be very beneficial, in order to deter from the future vain trials of, or dependance on them, in case, as there is too much reason to dread, the disease should be again brought into our country. For, by knowing they are of no avail, though recommended by writers the most likely to be consulted, much needless trouble and expence may be saved ; and the public attention transferred from them to more rational and efficacious means, by shewing they ought to be exploded as well on account of reasons drawn from just speculations, as a large actual experience of their failure.

relates

relates to the introduction, or spreading of the infection, into places, or countries free from it.

Among the means of prevention of the murrain, those the most generally adopted, though the least effectual to the end, have been the attempts to render the places where beasts are kept, or the beasts themselves, insusceptible of the infection.—In this intention, by an imitation of what the antients recommended, and practised, as preservatives against the plague, fumigations, scents, and external medicaments employed on the cattle, have been almost every where used.

With respect to fumigations of the places where beasts are kept, all confidence in them must fall to the ground, whenever the opinion of the air's being a vehicle of the contagion is refuted: as they were performed with a view to destroy the putrid effluvia with which it was supposed to be impregnated; and which was considered as the matter of the contagion.—But these fumigations frequently repeated, as they were for this purpose, in close places where the beasts were confined, were not only ineffectual to that purpose, but noxious in a considerable degree: as being very conducive to the prevalence of the contagion. For, being in general made with bodies, that afforded an acrid steam, such as sulphur, vinegar, tobacco, or terebinthinate substances, they injured the

respiration of the beasts; and thence diminishing the animal strength, rendered them more disposed to be affected by the contagion*. A multiplicity of facts confirm the truth of this remark: as it appears from nearly all the accounts given, that the greatest number of beasts have been lost, where means of this kind have been most employed.

The medicating the cattle externally, by rubbing them with sulphur, gunpowder, tobacco-water, and other substances, do less harm than the fumigations; but not more good: as experience has largely evinced. The same may be said of those extraordinary mundifications, or cleansings of the hair, and skin of the cattle, which have been recommended, and practised, on the same au-

* A free respiration of fresh undepraved air is essentially necessary to the strength of the beasts, in order to their resisting the effects of the contagion. It has appeared, from a number of observations, which are recorded by the writers on this subject, that the cattle, which have been kept out in the air, when the weather was not inclement through too much cold or moisture, have been less subject to take the infection, and recovered in greater numbers when seized with it, than those which were housed.—In Denmark, during the terrible visitation, mentioned above, of this disease in the year 1759, many of the boors attempted to preserve their cattle from the infection by the fumes of tobacco: which they continually smoked in the cow-houses, even sitting up the whole night in turns, for that purpose, in the midst of them. But it was remarked, that scarcely any of the cattle so treated, avoided the contagion, and death in consequence of it,—

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thority of the antients.—There is reason to conclude, that the contagion, in whatever part it is first imbibed, takes effect too soon to be rubbed off in time: and it is most reasonable to suppose, if the infection be at all, absorbed by the skin, this great cleansing of it, may fit, and prepare it, to receive the contagion, rather than defend it against its admission. All the supposedly preservative methods of this kind, though they have the authority of many writers, from an implicit submission to the more antient, have been found as vain and fruitless in practice, as they seem absurd in speculation, when examined on the just and demonstrable principles of physiology.

The use of the internal medicines administered, as antidotes, to fortify the beasts against the attacks of the contagion, have been equally inefficacious, or detrimental, with the external means. — Those of the medicines, that have been recommended for this purpose, which come within the class named alexipharmic, and are proposed to combat the *virus*, are intirely inadequate, in their degree of power, to the intention: though some of them, by their invigorative qualities, may have a tendency to oppose the effects of the contagion. — Those, which have been adopted as antiseptics, or resisting putrefaction, such as sulphur,

phur, oil of vitriol, vinegar, &c. when given as preservatives against the contagion, must of course be administered out of season. Since putrefaction in the fluids of the beast is the consequence, not the cause, of the contagion; and, therefore, cannot take place till the contagion be received: nor, as it did not before subsist, can it admit of being counteracted till then. Moreover, the substances of this kind, which are of an acid nature, have, in this case, a contrary tendency to that of resisting the effects of the contagion. For, destroying the bile, and checking, by other means, the digestive ferment, as well as lowering the *vis vita* from some other less known power, they weaken the habit of the beasts; and, consequently, dispose them to receive the infection more readily; and suffer, with less resistance, its action in bringing on a putrescent state of the fluids. It has been, therefore, every where found, that whenever any of these methods have been pursued, more beasts have been lost than when they were left to the friendly assistance of nature, undisturbed; and only secured from those accidents, that would injuriously affect their health in all circumstances.

There is another proposed method of saving cattle from the mortal effects of the murrain, of which some trial has been made, that properly comes under consideration

ation along with the preceding. Because, though it is not, indeed, the preventing the infection, but, on the contrary, the giving it; yet it is calculated to answer the same end: that is, the preventing the ill effects of the contagion by anticipative means. This method is, the inoculation of the cattle with the murrain, in the same general manner, as is practised with mankind for the small pox.

—The fact is well known, that beasts, which have had the murrain from accidental infection, like mankind, with regard to the small-pox, do rarely take it again: and, it being presumed on this ground, that the analogy betwixt these two diseases still holds good in other particulars; and, consequently, that the communicating the murrain by inoculation would have the same consequences, on the cattle, in preventing their receiving the infection again, and in rendering the symptoms of the disease proportionably milder, and less fatal; it was imagined, the use of this method might be, in a considerable degree, a substitute for a preservative from the infection itself. But experience has evinced, that this presumption was erroneous in point of fact: and there is, besides, one essential circumstance of difference betwixt the murrain and the small-pox, which constitutes the use of inoculation detrimental in the former, even if it were productive of the same consequence, as
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in the latter, with respect to the mitigation of the symptoms, or the prevention of future infection.—The experiments made to explore the effects of inoculation in the murrain, though not all alike in their result, have yet given sufficient lights to determine, that they are very different from those of inoculation for the small-pox: and that it can, in no degree, answer the same end, even with respect to the particular beasts subjected to it: much less can it conduce to the restraining, and diminishing the mortal effects of the contagion, in any manner, that may be beneficial to the public.

In the first place, it is sufficiently proved from instances, that the inoculation of beasts for the murrain does not hinder their receiving the infection again, as other cattle, by accident. This may seem very extraordinary, on the first view: because, when the cattle take the infection by casual means, and recover, they are rarely subject to have the disease a second time: and because, we see inoculation for the small-pox prevents the ill effects of future contagion, in the same manner as a casual infection. But reasons drawn from analogy, however just they may be in support of supposition, cannot cancel facts: and though the cause of this difference betwixt the small-pox, and murrain be of a dark and inexplicable nature, yet
nothing

nothing is to be thence inferred against its reality, as the subject itself is so, in all respects. For there has been no satisfactory reason hitherto assigned, why the having either of these diseases once, by any mode of infection, should be preventive of the future effects of the same contagion.—Whatever difficulties may attend the accounting for it, we yet find, on a revival of the relations of the trials of inoculation, practised for the murrain, a considerable number, in proportion to the whole, are known to have actually taken the infection afterwards: and that of these, the far greatest part died of the disease*. We may, also, reasonably pre-

* There are many instances of cattle taking the murrain a second time, after having just before had it by inoculation.

Noseman, and two other Dutch physicians, were among the first, who performed this operation in Holland. The beasts, they inoculated, were seventeen in number: and, out of them, three recovered; but took the infection again by accidental means, a fortnight after, in so violent a manner, that two of them died.

Professor Grashuys inoculated six beasts, which recovered. All of them took the infection again by accident: and four of them died.

There is an account, in the experiments of the Marquis de Courtivron, of two calves, that were inoculated twice without any apparent symptoms of the disease being produced. But they took the infection without any operation, afterwards, from other cattle, having the disease from inoculation: and one of them died.

In an experiment made last year, on the inoculation of cattle for the murrain, in consequence of a subscription formed for that purpose in Friseland; and reported

sume thence; that others of them might take the infection after the accounts were written; or under circumstances, which, might prevent the writers from attaining to the knowledge of it. It must, likewise, be considered, that among the beasts inoculated, a part must have been such as were not constitutionally susceptible at all of the infection, by casual means; and, therefore, did not take it afterwards on that score.—But, if we reason on the simple fact alone, that a considerable proportion of the number of the beasts inoculated have had the disease again; and with at least equal violence and

to the States-general of the United Provinces by professor Camper, it appears, that, out of ten, which recovered after being inoculated, the 5th of July, five took the disease again by accidental means; and all died.

In the continuation of the above experiments, seven beasts, which recovered, after being inoculated July 20th, all took the infection again casually afterwards; and were carried off by the disease.

It may seem difficult to conceive why more of the cattle that have recovered from inoculation, and taken the disease afterwards, should die of it, than of those which have not been inoculated, and are casually infected with it. But as inoculation does not, similarly to what is found in the small-pox, prevent the future action of the contagion with equal power; nor render the symptoms less violent, when the disease is received by that mode of infection, than when in the natural way; there is room to conclude, that the weakened habit of the beast, in consequence of the injury done by the disease in the inoculated subjection to it, renders the effects more fatal in the second attack, according to the principle we have above specified,

mortality

mortality, as those not before inoculated; we must grant, that this practice cannot any way answer the end proposed: which is solely, that of preserving them, for the future, against the bad effects of the contagion.

In the second place, it is, likewise, evinced, by the same testimony of facts, that the infection communicated by inoculation is not attended with less violent symptoms, and mortality, than when received by casual means. The accounts of the practice of that operation fully justify this assertion*.

* There are many instances, in the relations given of the trials of inoculation for the murrain, of the beasts dying in a great proportion to the number subjected to it. Amongst them are the following:

Noseman, and his two colleagues, as we have before had occasion to mention, inoculated seventeen; of which fourteen then died: and two of the others, which had recovered from that infection, took a fresh one casually; which appeared stronger, and carried them off. So that only one was saved out of the seventeen.

Doctor Fountayne, dean of York, had four inoculated; and lost one of them.

Doctor Layard inoculated eight beasts: of which five died: and he killed another for inspection; which, otherwise, might have been added to them for any thing that appears.

Four beasts were inoculated for the murrain, in the spring of last year, by order of the States of Utrecht: all which had the distemper with great violence; and died: as appears in the report, made to the states of that province of the opinion of some eminent physicians, they consulted; and of the result of this experiment.

The following numbers died from the inoculation performed in consequence of the subscription above-mentioned in the note, page 395, made last year for that purpose

Hence, therefore, as well as for the last-mentioned reason, inoculation appears evidently to fail of its intended purpose.

purpose in Friseland. — Out of twenty-five head of young cattle inoculated, the 5th day of July, ten died: besides the five others, which, though they recovered, took the disease again afterwards casually; and, then died of it, as before related. — Out of twenty-five that were inoculated, the 20th of July, thirteen then died: besides the seven before-mentioned, which having recovered, caught the infection by accidental means afterwards, and were carried off by it. — Out of fifty-eight, that were inoculated, the 9th of August, and took the infection, twenty five died of the disease then: and five more died soon after of a pulmonic decay occasioned by it. — Four other beasts were inoculated, on the same 9th of August, in which the infection failed. They were again subjected to the operation, the 18th and 19th, in a similar manner; and, taking the disease then, two died at the time; and a third soon after, from pulmonic abscesses brought on by it.

In these instances taken together, we find a far greater proportion of the cattle, destroyed by the murrain given by the inoculation, than would have been by the infection taken in the natural way. — Professor Camper says, nevertheless, “That such ill success should not discourage the future pursuit of inoculation for this disease: because the same miscarriages happened on the first introduction of this operation for the small pox into our parts of the world.” But I must beg his pardon for saying, that this is an inadvertent assertion: and that he is entirely mistaken in the matter of fact. For the inoculation for the small-pox was equally successful at first as now: and though extraordinary stress has been lately laid on some particular methods of treatment, supposed to be new; yet, where they have not been followed, we have two instances of a greater list of recovered patients, in proportion to those which have been lost under the same conduct, than can be produced on equal authority, by any of the pretended improvers
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The total insufficiency of inoculation to answer, in the case of the murrain, the end proposed, on the score of both the preceding circumstances, would be a sufficient ground for exploding the practice of it. But there is a yet stronger reason against its use; which arises from this principle.—The murrain is, at least with respect to the European countries, an epidemical disease, though contagious. That is, it does not, as we have observed before, ever reign, but when certain unfavourable circumstances of season have created a predisposition in the cattle to receive the infection; and thence rendered them temporarily susceptible of it. When the effects of these unfavourable circumstances of season cease, the effects of the contagion cease likewise; as far as regards accidental infection: so that, when the consequences are left to the natural course of things, this disease is only a temporary mischief, to which there is some certain period*,

of this practice. Some few, out of great numbers, have, at all times, died of inoculation for the small-pox: but never, in any proportion to the beasts, which appear in the relations here cited, to have died from inoculation for the murrain. It was the striking examples of success, which could alone have introduced and established the use of inoculation for the small-pox here: and it would have been rejected with horror, and prohibited by authority, had a similar failure to that, which has been experienced in the murrain, been found in the result of the first trials.

* Professor Camper, and some others of the Dutch physicians,

though that period may be different, as we have seen above, from the various condition

physicians have given it as their peremptory opinion, that the murrain will not cease entirely again in their country; but, like the small-pox and measles, only abate its violence, and confine itself to particular places in favourable seasons. The professor says in one passage of his printed Essay, "That it is more than probable, this contagious disease is become as permanent as the small-pox and measles." But certainly this notion is very erroneous, and contrary to a rational and just deduction from facts.—There are no parts of Europe which the murrain has been known to have ever invaded, that have not been known at other times afterwards to have been again free from it. A considerable stress may be properly laid on the more antient visitations of many places, of which we have accounts, whence it must often have gone away, as there were no traces of it found afterwards in them. Why, then, if there be any thing in the nature of the contagion, that renders it capable of establishing itself permanently, has it not been found to have done so in some places or other? Yet no such place is known where this murrain has always subsisted, from a considerable time backwards to the present. Even the United Provinces themselves, where the contagion's having now maintained itself for a number of years, last past, has given occasion to this apprehension of its having become perpetual there, was become again clear of any remains of that infection, which was brought into the country at the time of the general diffusion of it over all Europe, about the year 1713; and continued its force there till about 1721. It will be allowed, that not the least marks of this disease appeared during an interval of near twenty years, till it again was brought by a fresh contagion, about the year 1742, which can be traced to have come from a very distant part of Europe; and passed through the same countries as the former contagion of 1713. The professor himself acknowledges these facts in other passages; and includes the United

of different places. Now, if the inoculation for the murrain were practised in so general and continued a manner, as to render it of any public consequence, supposing the inoculated beasts incurred less danger from the

Provinces in the parts of Europe where he says, it was no more heard of till 1740. Now, if after raging so violently in the United Provinces in 1713, and 1714, as to carry off 40,000 head of cattle in less than two years, and keeping its ground for more than seven years, it then, entirely ceased; if it has, moreover, ceased in like manner, at various periods, in every other places where it has been known to have subsisted; what reason can we have to conclude, that it will now be perpetual; or, to use the professor's own expression, permanent, like the small-pox, and measles; which have never been found to quit any considerable tract of country once infested with them, though some small districts may be at times exempt from them.—The present extraordinarily protracted continuance of the murrain, in Holland, is easily to be accounted for from a longer series than common of unfavourable seasons, conspiring with the great relaxation natural to the cattle in so damp a country: which has kept them in a state susceptible of the infection at the same time, that, in other neighbouring countries, of a better temperature, this predisposition to the disease has not equally prevailed. But this peculiarity in the state of the seasons must, nevertheless, undoubtedly have some period; and, consequently, the prevalence of the contagion. The effect must cease in the United Provinces, as well as in other countries along with the cause; as it has manifestly always done before: and the disease, therefore, cannot be presumed to be rendered perpetual, or permanent as the small pox, or measles, unless the continuance of the unfavourable seasons, such as have succeeded each other since the year 1740, be previously presumed to be rendered perpetual: which is against the course of nature; as displayed in all preceding times.

disease by that mode of receiving the infection, and were more secure from future attacks of it, the contagion must be spread in proportion to the extent of the country where the operation is practised; and must, also, be constantly kept up in good as well as bad seasons. Hence all the natural means of the contagion's being exterminated, in the favourable times, would be wholly taken away: and, in the bad times, there would be necessarily a great destruction of such beasts, as neglect, or the casual want of opportunity of inoculation, had left exposed to the rage of it. This we see happen at present with us, in the instance of the small-pox, from the very extensive dissemination * of the infection by inoculation. But this disease differs very materially from that of the murrain, with relation to that operation. For we find no

* It is certain, from a very attentive examination of this matter, that a far greater number of persons have died of the small-pox in England within the four or five years last past, than have ever been known within a like period, for a considerable length of time. The inoculation of numbers, in almost all places, has diffused the infection through every corner of cities, and large towns: and the itinerant practitioners of the operation have conveyed it into every village of the country, even some, where it had scarcely before ever been known. By this means, all persons susceptible of the infection having been exposed to it, during a bad epidemical conjuncture, many have of course taken the disease; and been carried off.

instance

instance of the contagion of the small-pox being ever totally suppressed in any country, where it has once gained admission: and, therefore, if general inoculation mitigate the effects, it may be adopted for that disease without the mischief of causing a perpetuity of the contagion; as would happen from a general practice of it for the murrain: the contagion of which will, otherwise, spontaneously cease in certain periods; as past events have incontestibly manifested.

The failure of inoculation to answer its intended purpose, as evinced by the instances above quoted, and others, has disposed the favourers of it, not to insist on its utility, when practised on cattle in general. But Camper, De Monchy, and some others of those, who have most lately given opinions on this subject, still continue to recommend it to be performed on calves, or young cattle. But even admitting a greater number of them than of older cattle, might recover, when subjected to it; yet, if it be not, as we have above shewn good reason to believe, a security against future infection, it can be of no utility. The objection, moreover, against the general use of inoculation, with regard to its spreading and perpetuating the contagion, avails equally against the inoculation of the calves, as the adult beasts. For what will secure the other

cattle from this infection, when the calves have the disease in places near them? Will not this universal propagation of the contagion, in spite of all the care that can be taken, of course occasion its frequently reaching some of the older cattle: and will they not infect each other the same as at present, only in a more general manner? It may be answered, that, if all the calves be inoculated, the whole stock of cattle would in time be rendered insusceptible of the infection; and therefore not subject to this mischief. But if, which is, nevertheless, denied, for the reasons before specified, the inoculated cattle were rendered incapable of having the disease again; yet the detriment arising from the above explained effects of such a practice, before it could possibly be extended in any general manner; and the impracticability of making more than a part of the people conform regularly to it; would be extremely great. This plan has, besides, the further inconvenience of being incompatible with any supply of foreign cattle in places of great scarcity †. For the contagion being spread every-where by

* The want of a recruit, from other places, of the flock-cattle has been so great in Holland, that the destruction of the breed, and an extreme great scarcity of provisions, must have followed, if there had been no supply of foreign beasts. At present there is a most visibly deplorable deficiency of the flock, notwithstanding the great numbers, which have been lately brought from Holstein.

the constant inoculation of the calves, such foreign cattle would of course be affected by it: which must produce such a loss to the dealers in them, as would deter any persons from venturing on so dangerous a trade: whence the public distress would be greatly enhanced, by the scarcity of all cattle, thus occasioned.

We may, on the whole, conclude, that no general effectual aid is to be obtained against the murrain, in a *preventive* intention, by medicinal means. For such as might avail to a certain degree, in nature, are rendered impracticable from æconomical reasons. Whatever is done of this kind to answer any real purpose, must be extended to all the cattle in every stock; at least, where there are not very particular signs of strength; which will be found only in few. It must, also, be continued, or at least renewed at short intervals, during the whole time the infection is in the neighbourhood: as no foresight can point out when accident may convey it to the beasts. This must cause much expence in the purchase of the medicines; and constant trouble in the administration, which is in fact equal to expence.

Holstein. This circumstance alone is a sufficient objection to the proposal of inoculating calves; as such a stock, as could be thence raised, would by no means be adequate to the consumption; and the limitation of it would render the price of beasts exorbitant, and burthensome.

Professor Camper says, nevertheless, that nothing affords a greater prospect of success than preparing the humours while the cattle are yet in health, as the contagion approaches. But he seems aware, however, that the medicine which could be most depended upon for this purpose, the Peruvian bark, would be too dear to be administered in that profusion, which is necessary: and therefore, he proposes the finding some substitute for it; intimating, that he considers the willow-bark as such. But, unhappily, it is well known, that neither the willow-bark, nor any other hitherto discovered simple, is an adequate substitute for the Peruvian bark: and, though they have a degree of the same power; and may be joined with it to make some saving of the quantity; yet, given alone, they are not to be depended upon, and deemed equal to the intention. The expence of the Peruvian bark; or of strong-fermented liquors, or cordials; the only efficacious means of invigorating, and keeping up the sanative strength of the beasts, would be apparently more burthenfome to the proprietors of cattle, than that of replacing such of them, as might be carried off by the disease. Since, to put a large herd of cattle under a medicinal regimen, and continue it so for a long time, would most obviously be attended with a certain great loss, for the precarious

carious chance of avoiding another loss, that, at worst, could not be equal to it; nor, possibly, incurred at all; and would, therefore, be neither advantageous, nor in general practicable: as many proprietors of cattle could not find resources for making so considerable a disbursement.

The remedies, which have been tried for the *cure* of the murrain, have been in general as inefficacious, and absurd, as those employed for its prevention: and, though some few have been better chosen with respect to the intention; yet they never appear to have been well used as to the manner of administration: whence we have very few certain instances of their success. — The far greater part of these medicines, like those used for the prevention of the disease, have been taken up on the authority of the antients, and the earlier writers; and consist of a jumbled variety of those medicaments, which are deemed antidotes of poisons, or alexipharmics. Under this class, have been given theriaca, mithridate, diascordium, opium, camphor, balsams, frankincense, myrrh, juniper-berries, camomile-flowers, marygold-flowers, feverfew, rue, sage, fenugreek, madder-roots, grass-roots, horse-radish, bay-leaves, mustard-seed, snake-root, contrayerva-root, turmeric, safin, moth-massein, spearmint, calamus aromaticus, garlic, onions, leeks, testaceous powders, sulphur, vinegar,

vine-stalks, honey, raisins, figs, blood of a tortoise, and eggs *.—Some present physicians, on more modern, but perhaps not more just notions, have exhibited, to the beasts, several of the above, and other simples, under the name of antiseptics, in another intention; it is, that of resisting putrefaction; in which they principally place the cause of this disease. The chief of the remedies of this class, they have adopted, are the vitriolic acid, vinegar, verjuice, sour dough, butter-milk, common salt, and sal ammoniacus †.—Others, who are attached

* The notion of the nature and properties of antidotes, was very vague, and void of scientific principles, in the ancients: and the choice of their medicaments of that class, were accordingly, in many instances, absurd, and incongruous.—The general idea of what were called *alexipharmics* was more rational, and just; but the particular medicaments, adopted in this view, were, for the most part, very inadequate to the intention, even in slighter cases; and very injudiciously combined with each other in the compounds.—It is not to be wondered at, therefore, no remedy against so malignant, and violent a disease, as the murrain in cattle, should be found amongst those of this class proposed by the ancients, or their followers.

† The *antiseptic* class of medicines has not much more claim to propriety and efficacy, in the cure of the murrain, than that of the antidotes, and alexipharmics.—Though a putrescent state of the fluids be the consequence of this disease in the second stage, when the effects are violent; yet it does not seem to have any concern in the cause; nor, from any marks, even to come on in the first stage.—The effectual method, therefore, of doing somewhat, that may resist the putrefaction, is to mitigate the violence

to the doctrines of another modern school, considering this disease as inflammatory, have administered medicines, they hold as emollient and sedative; of which nitre, cream of tar-

violence of the disease: which can be only effected, as far as hitherto appears, by keeping up the natural strength of the beasts, through the use of an invigorative regimen.—The action of those remedies called antiseptics, may be, therefore, well doubted, as we shall have occasion to take notice more particularly below, with respect to their *immediate* effects in that intention, in any febrile cases, and more especially in the murrain.—Notwithstanding they check putrefaction in inanimate animal substances; yet, in living subjects, being taken into the intestines, their nature is changed by the digestive operation: and they do not pass into the habit with the same qualities; but as a part of the chyle, in which such qualities cannot exist.—Those of them that contain the astringent gums, which have the property of tanning, such as are found in the Peruvian bark, &c. may promote this intention, indeed, *secondarily*, by invigorating the solids; accelerating, consequently, the motion of the fluids; and thence aiding the natural ferments, which are the cause, why putrefaction does not take place in the juices of the living animals. But the acid kinds of the antiseptic medicines have, even, the contrary effects in febrile cases. For, diminishing the irritability, they lower the *vis vitæ*: and they prevent digestion, by checking that particular ferment by which it is performed. Whence, in both ways, they lessen the animal strength; and, of course, conduce to the putrescence of the humours.—These antiseptic remedies, moreover, can have no effect on the habit, in that stage of the disease, where the putrescence actually takes place. Because the digestion is then totally lost, as we shall see below; and the medicines, when taken, either remain in the stomachs of the beasts; or pass off in a colliquative purging. It is thence, we may account for the greater mortality of beasts so treated.

tar,

tar, acids, mucilages, and oils are the principal *.—Mercurials, antimonial, and white

* How far the notion, that the mortal effects of febrile disorders in general depend on inflammation, and that the indications of cure are to be thence deduced, may be just, does not make a proper object of examination here : though, perhaps, a medical error, in this point, has not only been destructive to many cattle, in cases of trials to cure the murrain ; but to a greater number of mankind than were ever saved by all the means of medicinal art. But, however that may be, it is obvious, the murrain cannot be classed amongst inflammatory disorders, when the symptoms of it, that will be below investigated, are duly considered. It must be allowed, indeed, that when the whole animal œconomy is perverted by this distemper in the second stage of it, the efforts of nature, to relieve herself from the discrasy of the fluids, produce inflammations in particular parts : the marks of which are constantly found. Inflammation is not, however, in the murrain, even the secondary cause of the disease itself, as it is in the small-pox, plague, and some other febrile contagious distempers of mankind ; but the last consequence of it, in the most advanced state.—On the contrary, the symptoms of the first stage of the murrain, and frequently of the second, exhibit no signs of general inflammation, but of general and partial weakness. A lentor of the animal action, a stupor, and a paralysis of the head and digestive organs, are, as we shall see below, the first visible effects. Where these are aggravated, so as to prevail over the efforts of nature to perform the vital functions, the disease necessarily proves fatal : but where the animal strength is sufficient to resist for a certain period, the disease terminates by a critical discharge of the *virus*, or morbid matter ; and the beast recovers. Certainly, therefore, the treating the murrain as an inflammatory disorder, by the exhibitions which diminish irritability, and lessen the *vis vitæ*, or animal strength, is conspiring with the efforts of the contagion to bring on the destruction of the beast : as those efforts prevail according to the weakness of the subject. It must be

vitriol have, also, been employed, in the intention of febrifuges, by some of the present physicians, who are favourers of chemical and metallic medicines *.

But alike has been the success of all the proposed remedies of these several classes : which is, that a remarkably great number

be admitted, indeed, that the medicines administered in this intention are not very powerful in their effect : but when conjoined to bleeding, or other evacuations, they have some share in rendering nature unable to resist the action of the contagion. They may, consequently, be granted to have contributed, in some degree, to that remarkable loss of the cattle, which has attended the attempts to cure the murrain.

* The trials of mercurials, as specifics for the murrain, were suggested by their efficacy in the venereal disease ; and, perhaps, in some others, which are contagious. But it does not appear, from any observation on facts, occurring in the trials made on it, to avail in the murrain. Indeed, had it been of more virtue in this disease, the effects of it, in the manner it has for the most part been administered for the same, must have been but slender. In the æthiops mineral, and cinabar, which are the preparations used, the mercury is so clogged, and locked up by its combination with the sulphur, that its action is weak and precarious. — As far as can be concluded from analogy, the antimonials might possibly have had some effect in this disease, if the proper kind had been administered on the first appearance of the symptoms. But, at the time these medicines seem most to avail in fevers of the human kind, that is in the last stage, they cannot possibly be of any service in the murrain. Because the digestion is then, as we shall see below, intirely lost in all the particular subjects, which would not recover without any aid ; and the medicines must, therefore, with them, lye inactive in the first stomach or cud-bag without passing further.

of

of the beasts, to which they have been administered, have died, in proportion to that of those, which have been left to nature. This may appear strange: but the fact is, that all of these medicaments, which have any operation, except those which have an invigorating and strengthening quality, disturb, in some way or other, the animal œconomy; and, thence weakening the beasts, render them more subject to the malignant action of the contagion, according to the principles above laid down.

The Peruvian bark; strong fermented liquors; cordials; and other medicines, which have the same tendency to invigorate, and are, thence, as will be shewn below, agreeable to the true indication of cure, have, amongst the rest, been tried by some few physicans in their treatment of this disease. But the manner in which they were used, either with respect to the period of the distemper, when they were given;—the want of due perseverance in the exhibition;—the joining to them injurious practices;—or some other circumstance; has been such, that but few instances of good can be shewn to have resulted from them: though enough to confirm what may be deduced from just principles of physiology, respecting this disease, as to their utility in the cure of it.

Bleeding has been practised by most, who have attempted to cure the murrain. Many have

have done it promiscuously, in every period of the disease : others have confined it to the first stage only. — Whoever considers the effects of bleeding on the habit ; and the nature of the distemper, as deduced from the symptoms ; cannot doubt but that this evacuation must have largely contributed to augment the extraordinary number of those beasts, which have died, when subjected to medicinal treatment, compared to that of those, which have been left to the favour of nature.—The failure of that degree of animal strength in some beasts, which is found in others, is, as we evidently see from the facts above-mentioned, not only the cause, why one part of the cattle takes the infection while another escapes it ; but also, why it proves mortal to one part of those seized with it, while the other recovers. Now it must be allowed, that bleeding, when to such degree as to have any effect, more than almost any other means, diminishes the animal strength, or the force of circulation. Must it not then, in proportion, conduce to bring the strong cattle to that state of weakness, which is the cause, as we have seen above, why the disease prevails over nature in some more than others ; and to render still more weak those which were so ?

It is not to be wondered at, nevertheless, that physicians, who have hastily considered the

the murrain as an inflammatory disease *, should adopt this most effectual means of

* The notion, that the murrain is an inflammatory disease, has arisen from the hasty conclusion of physicians, of its being similar and having a great affinity to the small-pox, and plague. But it will be manifest, from moderate observation on the respective symptoms of them, that there is no such similarity or affinity betwixt them in nature.—The small-pox always produces general inflammation, and consequently signs of a strong fever, in a greater or less degree in the first stage: and the excess of that inflammation is frequently the cause of its proving mortal. The same is seen in the plague, which begins with symptoms of strong fever and inflammation. Whence they may both be properly deemed inflammatory disorders: as inflammation is one principal secondary cause of the dangerous symptoms and mortality attending them.—But, in the murrain, no such inflammation ever appears in the first stage; but the very contrary: nor does any great degree of heat occur till either towards the middle of the second stage, and then only, in the case of a disposition to eruptions, when, as Dr. Layard has justly remarked, it is a prognostic of a recovery; or at the end of the second stage, when deposits of the morbid matter are made on the viscera; and soon induce a mortification. In the small-pox, an eruption is the sole salutary crisis, which nature has instituted; and through which, the subject can be saved. It is, therefore, together with the preceding and attending inflammation, and fever, essential to the disease. But, on the contrary, in the murrain, though eruptions are one mode of the crisis of the disease; or, in other words, one way by which nature discharges the morbid matter, when of due maturity; yet they are often wholly wanting, even when the beasts recover; and, therefore, not essential to the disease, even where it has its full natural progress. For in the United Provinces, and other moist and low countries, eruptions are most frequently not found in the beasts which do well: but a diarrhæa, or
looseness,

resisting inflammation : but there is not the least ground for this notion of the nature of the disease.

In the first stage, the contrary of general inflammation appears: for then the symptoms exhibits signs of languor and a disposition to insensibility. Nor is there any general inflammation seen in the whole course of the disease, except when deposits of the morbid matter are made in the last stage: which, if they prove eruptions or tumours in the external parts, are a salutary crisis, that should not, on any account, be disturbed or checked: or, if they fall on the internal parts, are a fatal symptom not to be resisted; and are then, moreover, attended with such a state of weakness in the breast, that any considerable evacuation must soon be followed with a mortal sinking.—At what time, therefore, is the bleeding to be practised with a view to the relieving against the inflammation? In the first stage, when there is a total absence of any such inflammation, and the whole danger of mischief lies in that of the want of sufficient strength: or in the last

looseness, constitutes the critical discharge: and, in such case, no great degree of heat arises in the whole course of the disease.—This proves an intire diversity in the nature of the diseases, to be betwixt the small pox, and the murrain; and evinces, that the indications of cure, which are adopted from a supposed analogy of them, stand on a very erroneous foundation.

stage,

stage, when there is such a state of weakness, that the evacuation must necessarily kill the beast; or such a critical eruption, as if suffered to take its course, may save the animal; but if checked, or thrown in, by the diminution of the fever, which supports it, must attack the internal parts; and either cause instant suffocation or convulsions; or, in a short time, a mortification of those parts*? In every light, this evacuation appears to be in-

* Dr. Layard, who, on the whole has written the most sensibly on this disease, says, "Bleeding, therefore, will be found necessary, only when the inflammation is so considerable, and the fever so high, that nature is obstructed; and cannot expel the morbid matter: and, whenever such symptoms are apprehended, prudence will require bleeding, to prevent this coming on, according to the constitution, strength, or age of the beast." But I must dissent from the Doctor, as to his opinion, that there are any cases, which admit of a rule to be laid down for bleeding the cattle in the murrain. That *inflammation does ever obstruct nature, so that she cannot expel the morbid matter*, is a mere hypothesis: and, perhaps, it might be, easily shewn to be such, as is not consistent with the known principles of physiology; I shall, however, wave any discussion of that kind here. It is sufficient to deny, that any such inflammation is found in the course of this disease: as no strong signs of any appear, but the shivering, and heat, in the earlier part of the second stage, which denote an eruption, and are, as above-mentioned, enumerated by the Doctor himself among the prognostics of recovery;—or the violent fever, which follows the attack of the disease on the viscera in the very last period; and is, consequently, always a fatal symptom. But admitting there were cases, when it might be beneficial to bleed the beasts, in this distemper, with a view to prevent the coming on of too much inflammation, or the consequences of it, when subsisting,

jurious in the murrain. For, if there can be a case supposed, where it might tend to

sisting, how are they to be certainly distinguished in practice? Few physicians would agree with each other, in settling precise diagnostic marks of this indication. How then are untaught owners of cattle, on whom the task of judging on this matter must depend in the general execution of it, to determine on a point of so complex, and nice a nature? On what, according to Doctor Layard's intimation, is to be grounded, *the apprehension of the symptoms, when prudence will require bleeding to prevent this coming on?* Some answer to that difficulty is, indeed, given in another passage of his Essay below, page 65, where he declares, "If a beast be full-grown, and fleshy, if a cow big with calf, and of such colour, as denotes strong fibres, then take away two quarts of blood from the neck. From a strong yearling calf, one quart: and so on in proportion to age and strength; but neither weakly, nor poor thin cows, especially white ones, are to be bled so much, if at all." But in the third chapter, where he treats of the prognostics, he enumerates these circumstances among the marks, by which it may be discerned what beasts are least in danger of being attacked by the contagion, and suffering violently from it; all which marks are, in fact, the appearances of strength, though he has not directly said so. Now, if strength be the preservative from the contagion, and its effects, what is the consequence of bleeding those which bear such marks, but, in fact, reducing them to the same state with the others, which want this strength; or, in other words, rendering them equally unable to resist the effects of the contagion?—Is not this setting up of art founded on vague principles, for the sake of accommodating practice to the notions and hypotheses of darling writers, in opposition to the clear dictates of reason, suggested by observation on facts.—In chapter the eighth, speaking of the means to prevent infection, he is led round again to truth, by the force of such observation. For there he very justly acknowledges the real fact, that

relieve against a particular symptom, which is only when some internal part is inflamed by the deposit of the matter; yet such case would be desperate, and the evacuation would, in other respects, promote those effects that lead to fatal consequences.—

Bleeding for prevention of the infection, though not enumerated in the preceding view of the means used for that end, has yet been recommended by some physicians; and frequently practised. But, on the same principle, of exposing the beasts to the force of the disease by weakening them, it is of the same bad tendency, as when used for the cure. Indeed it does not in this case so generally do harm. For when it happens not to be performed nearly at the time of the beast's taking the infection, the cattle, except those which are naturally weak, re-

“Bleeding, and purging the cattle, so far from being of use, has not prevented the disease; but rather the symptoms have been more violent in some, who were blooded, and purged.” The reason is obvious: because, being weakened, the beasts were less able to resist the contagion. But has the bleeding less effect in weakening the subject, when performed after the infection has taken place than it had before? Surely it has not.—This was delivered candidly, from observation on the real phenomena. What we have before quoted was the result of theoretic reasonings, founded on presumed principles, and the supposed authority of Sydenham, &c. in points, where in reality no just analogy subsisted.

Professor Camper wholly disapproves of bleeding in this disease, from an extensive observation of its effects.

cover

cover their strength again: and the evacuation has, therefore, no consequence with regard to the distemper.

Purging has been frequently tried as a remedy against the murrain, in all the periods of the disease. There is evidently the same objection to it, as has been made above to bleeding: since it undoubtedly conduces to weaken and exhaust the beast: and consequently to render nature less able to resist the force of the contagion.—It is, also, from other reasons, improper in this disease, by which-ever of the two courses, a diarrhæa, or eruptions, nature seeks to produce a critical discharge of the morbid matter. Where there is a tendency to eruptions, as for the most part is found in England, this evacuation would necessarily make a derivation, and endanger the stopping its progress: and, indeed, not only with us, but in Italy, according to Lancisi, “A looseness is an unfavourable symptom; and denotes the weakness of the subject.” In Holland, it is frequent; and the cattle do recover with it. But where there is a disposition to it, or it is already begun, medicines which promote the same evacuation, are certainly not proper: as they either bring it on before the due time; or increase it, if already come on, to a degree that is beyond what the strength of the beast can bear. This, though not perhaps in every instance, must

yet be the case in the greatest part.—The most judicious observers agree, moreover, in condemning the use of purges in this disease, from an actual experience of their bad effects: and the adopting it has been certainly one source of the ill success which has resulted in the attempts made to cure the murrain.

Blisters have been, also, tried in this disease; but not in so extensive a manner as to afford the means of determining, how far they may be of any avail in it.—By the apparent tendency to a paralytic state, which is shewn in the first period of the murrain, there is room to conclude, that such a *stimulus* might come within the intention of cure. But whether it would be adequate to the indication, or trivial in its effects, can only be known from a large basis of observation. At all adventures, the difficulty attending the application of blisters to the diseased cattle, by such persons as must have the treatment of them in general, renders their use a very unfit means of relief in the murrain.

Rowels, setons, pegging, and caustics, have been in their turn vainly employed in the murrain. It must be admitted, nevertheless, that nature sometimes throws the morbid matter on a part already diseased by a wound so made: and, in that case, renders it the means of a critical discharge: as we see happen in other contagions. But this will rarely
ly

ly be the case : and where it may, there is always a sufficient degree of strength to produce an eruption, which would answer the same end. In any other circumstances, the discharge from these drains can be of no service towards the cure of the murrain. For they must know very little of physiology, and the history of diseases, who imagine a purulent discharge can be of any consequence in them, unless, at the due period, it be converted into a critical one, by a deposit of the morbid matter on the part. In all other views, this kind of evacuation rather impedes than promotes the cure of the murrain : as it tends to weaken, and exhaust the subject ; and, consequently, to promote the prevalence of the contagion over nature.

Mundification, performed by extraordinary cleansings, and rubbing the skin of the beasts, has had great stress laid upon it by some, who have undertaken the cure of the murrain. But it is admitted, by professor Camper, and others, who have seen it much practised, to be of no avail. Indeed, the effects must be too minute, to have any material consequences in a disease of so violent a nature : and if such laborious, and constant cleansings, rubbings, &c. as are recommended were serviceable, the performing them would be impracticable, where there are a great number of cattle infected, without

more trouble or expence, than the chance of benefit from them would countervail.

The inefficacy of the above enumerated various supposed remedies for the murrain are less to be regretted: because a great part of them would be attended with such expence, and trouble, as would render their general use inexpedient. And, indeed, the same may be said of all of them, according to the manner, they have been prescribed by those who have recommended them: in which several always; and, for the most part, many of them; have been combined together. — Whatever method of cure is proposed to be actually serviceable in this disease, it must be practicable with a moderate share of expence and trouble; or it will never be put in practice, by the proprietors of the cattle, so generally, as to save a sufficient number of them to be of any moment to the public. Very little regard has, nevertheless, been had to this consideration by the physicians, who have taken in hand the discovering means of relief against the murrain. They seem only to have sought after what might be efficacious in nature: and directed the use of what they thought so, without calculating in the least, whether the consequence of its use could be lucratively of any benefit to the private persons, who might adopt it; or reflecting, that if it were of no benefit to them, they would not adopt it; nor the

the public, therefore, reap any advantage from it. Even the most able of those, who have been engaged in this pursuit, have seemed to forget wholly this circumstance; which is indispensibly requisite to the forming an effectual plan for the saving any material number of the cattle: as it would be more profitable to abandon them to the effects of the disease, than to incur a greater expence in attempting it, than is ballanced by the value of the chance of saving them *.

* In calculating the advantage, that is to be received from any remedy for the murrain, the expence incurred, by the use of it, for the number of beasts actually saved, must not be considered alone; but that of all those, with which it has been used, in order to the saving such number, must be included likewise. In order, therefore, to determine the value of the chance of saving the cattle by any means of remedy, comparatively with the cost of such means, it is proper to state the circumstances in this manner:—It appears that, at present in Holland, somewhat less than half the beasts, which take the infection recover, without the aid of any medicinal assistance: and in our country, where, as we have before observed, the beasts are stronger, we may, safely reckon at least that proportion. But, as it is impracticable, when the signs of the distemper first appear, to distinguish, with any certainty, those beasts which would die without aid, it is necessary, all those, that are seized with the disease, should be subjected to the curative treatment. Let us further, in order to bring the whole matter into this point of view, suppose a method proposed, that would, save one half of the beasts, which would die without the aid of it. It will then result from these premises, that, on the whole, to save one beast, the expence of the medicinal treatment must be

The knowledge of those symptoms, which are easily discernible, and best distinguish the murrain from other disorders incident to cattle; and of the peculiar appearances, that are produced in the inward parts of beasts which die of it; make, by far, the most important object of the communication of what regards this disease.—It is extremely requisite, that all owners of cattle should have a moderate acquaintance with these matters, in order they may as soon, and as certainly as possible, be able to inform themselves, whenever their cattle appear to be

incurred on four: as one half would recover, if they were left to nature; and only one half of the other is to be saved by the medicinal aid. For a method which could effect that must be justly deemed highly efficacious.—In the methods, which have been recommended, and particularly that by the latest and best writer on this subject in our own country, the expence of labour, medicaments, and extraordinary diet, would amount in the treatment of each beast, to at least one pound five shillings; and, according to some prescriptions, they would rise to double the sum: so that, in any of these methods, according to the manner of computing here laid down, the saving each beast would cost at least five pounds; and in some of them ten.—This great expence would not only take away all inducements, in the view of gain, from the owners of the beasts to employ such means for saving them; but the greatest part of such owners would not be able to make the disbursements necessary to it, in proportion to their stock of cattle. As the whole must be provided, and laid out in a short space of time: and it would, therefore, be more to their interest to submit to the present loss, and recruit their stock by future resources.

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out of order, or die in a suspicious manner, whether they be infected with this disease, or not.—Without such means of judging, they may either inadvertently suffer the contagion to spread in their own herds, or to those of others, if it happen to be introduced to any of their beasts; or, otherwise, be led, from a mistake of other distempers for it, to be at great expence and trouble, in endeavouring to prevent it, when there is no real occasion.—It is of equal consequence both with respect to the public, and to themselves, that a certain degree of intelligence of the criterions, by which the murrain may be known from other disorders, should be possessed by magistrates, constables, parish-officers, and inspectors of cattle, particularly those near sea-ports; that they may, in some measure, be enabled to put the acts of parliament, and orders of council concerning the disease, into execution: as those acts lay a task upon them, should the occasion of their being enforced present itself, of a very nice and complex, as well as momentous nature.—I shall, therefore, first give an enumeration of those symptoms of cattle diseased with the murrain, and a description of those appearances it causes in the inward parts of the bodies of beasts that die of it; which are so simple and strong, that they may be readily perceived, and distinguished by any persons, however
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little versed in the observation of diseases, or other subjects of medicinal concern.—I shall afterwards, for the use of others, who may chuse to cary their speculations further, and attempt the study or cure of the disease, point out those more latent, and less perceptible symptoms and effects of it, which require a previous knowledge of physiology to their being properly observed: and which are rather useful for investigating the nature, and kind of the disease, and the best method of curative treatment of it, than for distinguishing it, by sensible marks, from other disorders of cattle. I shall proceed also, to apply the whole to that purpose of examination; and to explain whatever can be at present collected of the physiological principles of the disease, in order to ascertain thence the best means of prevention of the contagion; and the proper intention of cure to be adopted in the medicinal treatment of such as are already infected.

The first apparent symptoms of the murrain are,—A dry cough:—a shivering, and gnashing of the teeth, coming on at considerable distances of time:—shaking the ears; and hanging down of the head, as if from weakness:—stretching out of the neck, as when there is a difficulty of swallowing:—moving often slowly from place to place, seemingly in a constant state of uneasiness:—decrease of appetite:—diminution,
or,

or, on the fourth day, total loss of milk, in cows, which are in a milch state; attended with a lankness of the belly and udder*; and sometimes costiveness. — During the time these symptoms *only* appear, the cattle will eat; chew the cud; and, at some times, look brisk, and lively: but, after the third or fourth days, the following symptoms come on gradually, but quickly; except in those beasts, which have the disease in a very mild and gentle manner:

A constant heaviness and stupidity: — a general weakness: — a great decline of the appetite, and chewing the cud: — a frequent trembling of the whole skin; or of particular parts of it, especially about the flank, and

* Doctor de Monchy, city-physician to Rotterdam, in his *Remarks on the mortality among the horned cattle*, mentions a decrease of milk, and a lankness of the belly, in milch-cows; and a drowsiness and cough, in young beasts; as sufficient signs, to discover this disease in the cattle. But though they may be good reasons for suspicion of it, in places where the contagion is already in the neighbourhood: yet they are by no means *alone* just grounds to determine, that cattle so affected are seized with the murrain, when there is no likelihood of the infection's having been conveyed to them. The decrease, or even loss of milk, in cows, and the consequential lankness of the belly, are attendant on any considerable feverish disorder: and the drowsiness, and cough, in young beasts, may arise from colds, or other epidemic disorders. I have mentioned this, because Doctor de Monchy's dissertation has been lately translated into English: and such a passage in it may mislead; and occasion false alarms respecting the introduction of the contagion into our country.

buttocks:

buttocks:—a purging in some; or a discharge from the nose, and ears:—and a total loss of the milk in milch-cows, if it has not come on before.

Where the disease is not slight, the above-specified symptoms are soon succeeded by these others.—A refusal of all food, and ceasing intirely to chew the cud:—an increase of purging; the excrement becoming of a very yellow, or of a dark green colour; stinking; and, in some cases coming away of itself from the fundament, which seems continually open and moving:—a difficulty and shortness of breathing, accompanied with groaning, and an extraordinary distention and widening of the nostrils:—a scabbiness of the nose and lips:—a great swelling of the belly:—a restlessness; uneasiness on lying down; and defect of power, through weakness, to stand, whence the legs are extended outwards, as it were to prop the body:—eruptions on various parts of the body, but particularly about the flank and udder:—miscarriage in pregnant cows:—and, where the beasts are strong, hard tumours, like boils, especially along the back on each side the bone felt under the *panniculus carnosus*, or outward skin; which frequently break, and discharge matter very fetid or stinking.

These symptoms go on, most of them augmenting, till the turn or crisis of the disease. They then begin to decrease, and some degree of appetite, and chewing
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the cud to return ; if the beast recover.—If otherwise, the purging becomes greater ; or, if there were none before, begins with violence : and the dung passes off involuntarily ; not only the anus but the tail seeming to lose all power of action. The eruptions, if there be any, flatten ; or the tumours, like boils, under the skin, grow soft ; and the strength seeming to be spent, the beast dies suddenly without any other previous signs ; or, in some cases is violently convulsed, roars loudly, throws out a large quantity of foam or froth from the mouth, struggles hard, and tosses about the head with great force.

The second stage of the disease is seldom continued longer here than three or four days : reckoning it, as above-mentioned, from the fourth day after the first signs of the infection. So that the general period of the distemper, from the first attack which was perceived, to the crisis, or turn, according to the course of the distemper, as it subsisted here, may be accounted about seven or eight days *.

* In Holland the period of the murrain, from the first sensible marks of it to the crisis or turn, is much longer than it appeared to be with us, and is most generally found to be about twelve days. The reason of the variation of the disease in this point, betwixt Holland and here, lies in the superior strength of our cattle ; which enables nature in them to bring the disease to a crisis in so much less time. This greater degree of strength in our cattle manifests itself, as we have remarked elsewhere,

The time of appearance of the first signs after the infection is received, is five or six days; rarely more; unless where the slightness of the disease renders the symptoms so gentle, that they do not become perceptible till in an advanced period of it: but this cannot carry it beyond the ninth or tenth day.

It is not to be understood, nevertheless, that, in every beast, which has the murrain, all the above enumerated appearances will be found. For as different parts are affected in different subjects, the symptoms vary accordingly; particularly in the last stage: and the natural, or casual habit of the beast, as to strength, age, and pregnancy, makes likewise a considerable alteration, both as to the kind, and the degree of the effects of the contagion.—The symptoms of the first stage, except the costiveness, constantly attend, however, in a greater or less degree: and the greatest part of those of the second stage follow in a more or less violent manner. The discharge from the nose, and eyes is very general; and scarcely ever wanting in those beasts, which recover. The purging, and swelling of the belly, are, also, very fre-

where, in their more frequently throwing out eruptions in this disorder here than in Holland; and in their not being susceptible of the infection, except after very bad seasons; though less injurious epidemic causes render them so in that country.

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quent; and almost always occur in those beasts which die. The eruptions, and hard swellings like boils, are, likewise, very common here *, in those which recover.

On the whole, therefore, by a due observation of the manner, in which beasts seem affected, when several are seized with an unknown disease, at nearly the same time, and place, it may be determined, on very good grounds, when the contagion has been introduced.—The hanging down of the head, and stretching out of the neck, with other signs of weakness, coming on in the first stage; and followed by the insensibility, tremblings, eruptions in the flank and udder, or hard swellings like boils along the back, and breaking out, or scabbiness about

* Though eruptions were very frequent in the murrain while it prevailed here, yet they are much less common, as has been above intimated, in Holland, and other low and damp countries, where the cattle are habitually weaker. When they do appear there, they are, also, different for the most part from those found in our cattle. For instead of being on the back, and large like other boils, they are generally about the flank and udder; and are less, flatter, and softer. The general crisis of the disease, in such case, is not by eruption, but by a diarrhæa, or looseness, which was found here, on the contrary, to be mostly a bad symptom. This is not, however, constant. For there are instances of beasts which do well in Holland without a diarrhæa: and there were some here, of those which recovered with it. But the crisis, nevertheless, is here, by far the most frequently, an eruption, either on the back, or about the nose and lips; and, in those countries, a diarrhæa.

the nose and lips, in the second stage ; may be looked upon as peculiar symptoms, which characterise the disease ; and leave little room to doubt of its presence, where they appear.

In order, nevertheless, to obtain a more positive certainty, in any case, where there is reason to apprehend, from beasts having died in the manner, and with the symptoms above described, that the infection has been brought to any place, it may be further proper, to examine the carcases of such beasts by opening them ; and if it be as supposed, the following appearances, or most of them, will present themselves. This examination must, however, be confined to such as die from the natural course of the distemper ; and not extended to such as are killed, or have been subjected to medicinal treatment : because the disease has not then had its due and full effect on the parts ; and the state, in which they will then be, must proportionably fail to answer the description above given.

A very stinking air, and sometimes matter, rush out on piercing the skin, or making an opening into the cavity of the belly ; particularly, if there be swellings on the back, and the skin be prickd or cut in that part. — The mouth, throat, and gullet, are red ; and full of small specks, or ulcers, attended with the appearance of what is
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called the thrush in children.—The lungs are red, ulcerated, speckled with blackish spots, and sometimes fraught with small bladders of fluid like water.—The liver is swollen: full of dark yellow gall; and rotten, so as scarcely to bear the touch: and the gall-bladder is stretched to a large size by greenish gall.—The cud-bag, or paunch, is red, and discoloured with blackish spots; puffed up with air to a very great magnitude; and void of any fluid, but containing a hard mass of cud, which has remained there, and is become dry, instead of passing to the other intestines to be digested.—The honey-comb, manifold, and curd-bag are in much the same state with the cud-bag, except, as to the various degrees of hardness and driness of the cud, in the two first; and that the curd-bag is empty.—The smaller guts are spotted with red and black: and the end of the *rectum* or last gut, for some space above the anus or fundament, is black, rotten, and foul with clotted blood on its surface.—The womb is red, and enlarged, in cows that are not pregnant: but, in those with-calf, it is blackish.—The fat, where any can be found, is of a high yellow colour, and soft consistence.—Collections or gatherings of matter are, frequently, met with in the cavities of the horns, and head.—When the greatest part of these appearances present themselves, in the respective parts, on

opening the beasts, which have died after the principal of the above symptoms have been observed in them, there can be no room to doubt, but that they have had the murrain. —Even where any accurate information may be wanting of the nature of their illness, there is a very strong ground of conclusion, that it was this disease, if, on the examination of the carcases soon after the beasts are dead, the eruptions, particularly the hard boils along the back; the scabbiness on the nose, and barbs; the puffing up of the skin, or belly with stinking air; the gathering of matter in the horns and head; the dry mass in the cud-bag; the blackness of the womb; and the rottenness of the gut, next the fundament; or most of them; are found.

The symptoms and effects of the murrain, which may be deemed, less properly than the foregoing, the subject of the examination of persons not conversant in medicinal subjects, and less apparently the characteristic marks of the disease; but which may yet afford material lights for discovering the true nature, and the indications of cure of it; are those which follow.

In the first stage, heat, but not great, in the head; and particularly at the roots of the horns; attended with a coolness of the body, and the extremities:——hot and stinking breath:——deafness: pulse quicker than in health; the strokes being from
sixty

sixty to seventy, but irregular, though without stated remissions.

In the second stage, signs of sickness * : —breath more hot and stinking : —fetid, steams from the skin : —respiration difficult ; particularly expiration laboured, and performed with groaning : —urine high-coloured, and turbid ; but generally without any deposit of sediment, or any bad smell ;

* Doctor Layard has mentioned, along with the sickness, the throwing up of bile as one of the symptoms of the murrain. He does not intimate, that he had seen it himself ; but refers for it, in a note, to *ARETÆUS De morbis acutis*. The notion of such a fact was a most palpable error in the first broacher of it, whoever he were ; and it is a great inadvertence in the Doctor to adopt it : as he has himself, in more than one part of his treatise, insisted on the impossibility of neat cattle's vomiting at all on account of the formation of their intestines. Professor Camper has, indeed, seemed to contradict this opinion by the relation of a fact. For he declares, that giving a decoction of camomile has made the beasts vomit. If that did happen, however, it cannot be supposed to be any other vomiting than the returning the fluid into the mouth from the cud-bag only, by the same action, as the cud is brought back thither in order to rumination : which could have no effect towards forcing up bile. Whoever considers, that the bile must pass through all the four stomachs, in its way from the duodenum to the mouth, must be satisfied, that it is next to an impossibility, any such thing should happen. It is most rational to believe, that, if a discharge from the mouth, of any thing resembling bile, on a slight inspection, has been observed, it was only of some yellow cud mixt with a large proportion of fluid, and mistaken for bile in default of stricter examination,

and retained longer than in health, though not in the whole much different in quantity:—dung acrimonious or sharp to such a degree as to leave a visible irritation for some time after in the anus:—blood florid:—seeming exacerbations of pain in the evening:—a constant disposition to lye, but attended with such uneasiness in some, that they stand almost continually, though with great difficulty on account of their weakness:—an absence of thirst throughout the whole disorder, though with a willingness to drink in moderation:—pulse increasing in quickness, according to the progress of the disease, from seventy to ninety; and having periodical diurnal remissions, as in the paroxysms of fevers; but irregular, intermitting, and growing smaller as the velocity becomes greater.

On opening the carcasses of beasts dead of the murrain, these appearances will occur, together with those before enumerated.

In the brain, the blood-vessels are found turgid and very red; and clots of grumous blood, as well as a lymphous fluid, shew themselves frequently in the substance.—On the membranes of the cavities of the nose, and the whole extent of the frontal sinus, the large glands, and the medullary substance of the horns; marks of inflammation and excoriation will be seen.—The kidneys, and bladder, are inflamed, and void of urine.—The flesh, in some beasts is livid; in others of
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a lively red, for a short time after the death of the beast, but soon changing to a green colour.—Appearances are found of *emphysema*, or vesicles of air, in the lungs, mesentery, and cutaneous membranes in various parts, of the body.

From the whole of the symptoms, and appearances, of the murrain, we may draw these conclusions, as to the nature and effects of the disease.

It is communicated from one beast to another, by a contagious matter, or *virus*, that, acting as a leaven, produces a ferment in the humours of the parts into which it is introduced; and either reduces the nerves of such parts to a paralytic or inactive state; or renders them too irritable and active: at the same time counteracting those natural ferments in such humours, which are requisite for the due support of the animal œconomy. But when, from the strength of the solids, giving due motion to the fluids, the natural ferments are duly powerful, it cannot prevail over them; and, therefore, has no morbid effect. As we see in those beasts, which escape the infection, though exposed to the contagion.—In those subjects, where, there is a default of such strength, it goes on, by the above specified means, to weaken the force of the circulation; and deprave the secretions: whence, also, that putrescence, or putrid ferment, to

which all animal substances have a natural tendency, when not superseded by the vital ferments, is at length brought on; and, if no critical expulsion be made, in due time, of the contagious leaven, by the fever induced by its effects, destroys the vital œconomy; and, necessarily, causes the death of the beast. But, if, by the inflammation produced, the force of circulation, and consequently the power of the vital ferment, be so increased, as to overcome that of the contagious leaven, the morbid matter, in which it resides, is expelled, either in eruptions on the surface; or by a discharge from the intestines.

The progress, and the manner of the action of the contagious *virus*, in the murrain, may, from the symptoms and the appearances in the dead beasts, be deduced to be as follows:—The first effects of the contagion appear principally in the head, and upper parts. It produces a certain degree of nervous weakness or paralytic disorder in those parts; as is shewn by the deafness, dulness of the eyes, debility of the neck, and shaking of the head. This disorder affects also, gradually, the glands, which secrete the saliva, and lymph of the stomach: as there is found, in a more advanced stage of this disease, a total want of those fluids: the cud forming a dry concreted mass. At the same time, nevertheless, the glands of
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the nose, and eyes, are rendered more irritable: and the humours are secreted in them much more copiously than the natural degree. The paralytic disorder of the salival glands, and the glands of the stomachs, extends itself frequently, in the first stage, to those of the small guts: as may be inferred from the costiveness observed at that time. But this often changes afterwards into a great irritability in the second stage: as is evinced by the profuse diarrhæa attending.—On the other hand, the irritability of the glands of the nose, and eyes, seems to be continued to the membranes of the lungs, by the cough, which is almost a constant symptom.—The stomachs seem, also, to partake of the paralysis of the upper parts: and this appears to be in proportion to their nearer situation to those parts: as may be inferred from the retention of the cud in the cud-bag and honey-comb, and the emptiness of the curd-bag.—There is an early effort of nature, to make an expulsion of the morbid matter by the external parts of the head: as may be collected from the signs of topical inflammation, which shew themselves; and particularly about the horns, where abscesses are afterwards frequently formed. But this alone rarely proves a critical discharge.

After the first four days, the contagion diffuses its effects much more generally; and frequently attacks the liver, and the lower

intestines; which then become very irritable: a great discharge of bile, and the other humours secreted in them, ensuing. But the inactive, or paralytic state of the salival glands, and those of the stomach, yet goes on increasing, till all secretion by them cease. Hence the appetite, and digestion, are entirely lost: and the inanition, caused by the want of a due supply of chyle to the blood, conspires greatly with the nervous debility, above specified, to bring on a great languour of the circulation, and other vital action. This necessarily induces a putrescence of the juices; whence new sensible effects are produced; which may be deemed *secondary* symptoms: being not the immediate consequences of the action of the contagion; but the effects of the putrid ferment suffered to prevail by the suppression of the animal ferments, which counteracted it while they subsisted in the due degree. In this difference of the cause of the symptoms, principally consists the difference of the first and second stages of the disease: the first exhibiting those alone, which result from the action of the contagion on particular parts; and may, therefore, be called *primary*: the second displaying not only a further extension of such symptoms; but those others, also, that are caused by the general depravity of the fluids, and the consequential disorder of the vital oeconomy, which arise from the putrescence,

treſcence, that prevails from the weak action of the ſolids, in giving due motion to the fluids ; and from the defect, or perversion of the glandular ſecretions. In this advanced ſtate of the diſeaſe, a final period is ſoon brought on, either by a ſalutary criſis, or the death of the beaſt. — The morbid matter falling on ſome particular parts, and the general depravity of the humour cauſing obſtructions in others, topical inflammations, and a general irritation follow : whence, neceſſarily, a fever riſes in a greater or leſs degree. By this means, the force of circulation is increaſed, ſo that, where the habit is ſtrong, the natural ferments, being again revived by the accelerated motion of the fluids, prevail over that of the leven of the contagion : and the morbid matter is either thrown on the ſuperficial parts, in caſe of great ſtrength, where it forms eruptions, and tumours ; or diſcharged by the glands of the inteſtines, in caſe of a leſs degree of ſtrength. This conſtitutes a ſalutary criſis ; in conſequence of which, the beaſts recover from the murrain, at leaſt conſidered as an acute diſeaſe : though they ſometimes die afterwards of the ulcerations or abſceſſes produced then, by it, in the brain, lungs, or other viſcera.—But, if the natural ſtrength be ſo defective, that the irritation, and conſequential fever, cannot produce a ſufficient force of circulation, to give due power to
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the vital ferments, the contagious leaven and putrescence overcome them: and an excessive evacuation is made by the liver, and the glands of the small guts, which exhausts the remains of that power on which animal action depends; while the external and weaker parts suffer a gangrene from the deposit of the morbid matter, and the want of due motion of the vitiated and putrid humours.

This investigation of the progress and manner of action of the contagion, according to the state of the subject, in the murrain, affords a clear view of the indications of cure.—It is evident, that the struggle here, betwixt health and the disease, lies in fact, at first, betwixt the vital ferments, which support the animal œconomy, and a preternatural ferment, which tends to destroy them: and that, consequently, if the latter prevail, it introduces the putrid ferment to which all animal substances have a disposition, when it is not controlled by the vital. It is certain, also, that the vital ferments depend on the due commixture of the several humours, and their constituent parts, by the circulative motion of the blood, and those other motions of the animal juices, which are performed by nervous action; and that these motions are more, or less strong, in proportion to the nervous strength of the subject: or, in other words, that they are rendered vigorous, or languid, as that strength is

is augmented or diminished. Whatever, therefore, increases this nervous strength, or gives tension to the fibres, increases those motions: and whatever adds to the force of those motions, proportionably increases the vital ferments; and consequently resists the action of the contagion: which cannot take place while they maintain themselves in their due power. — Hence it follows, that the way to assist nature against the attacks of this disease, is to keep up the animal strength by such invigorative means as are compatible in other respects with the salutary œconomy*.

To invigorate, and strengthen, by the administration of such medicines, as give force to the action of the nerves, and tension to the fibres, is the principal absolute intention of cure: which is dictated by the general nature of the contagion, and its mode of operation. — But there is moreover a palliative or *secondary* intention, which arises from the consideration of a peculiar symp-

* The same intention of cure, as is here proposed for the murrain, is now pursued, by all able physicians, in the contagious, and other diseases of mankind, that induce a putrescence: experience having shewn; that it is the only means which avails in such cases. It is, therefore, demonstrated to be the proper method of treatment of cattle in the murrain, not only by reasons deduced from the symptoms of the disease, and the observations of the cause, why, amongst the cattle left to nature, some escape, and others are carried off; but also, from analogy, on comparison, with the facts respecting similar diseases.

tom.—It appears, from what is above laid down, that the state of the parts subservient to digestion denies the performance of that office on such food, as requires the aid of saliva, and the lymphous juices secreted in the stomach: whence the power of the contagion is increased by the weakness resulting from the inanition, and the depravity of the humours, in consequence of the want of a supply of fresh chyle to the blood. It is, therefore, a just, subservient intention to furnish a proper quantity of such food, of a fluid consistence, or divided texture, as can be digested under these circumstances; and thence to support the strength of the subject: which must, otherwise, sink from the concurrence of this additional cause of weakness with the effects of the contagion, and putrescence.

The primary intention of cure in the murrain, according to these principles, is to be executed by the administration of such corroborative, and cordial medicines, as give due tension to the fibres, and vigour to the nerves: removing the spasmodic insensibility, and impediments to their action; or their too great irritability, whence an irregular mode of action is produced.

There are various kinds of medicaments, which have these powers. But experience, in the case of similar diseases, and the consideration of general fitness to the peculiar circum-

circumstances of this, point out two species, which are more peculiarly proper, as well as efficacious.—These medicaments are the *astringent, febrifuge, gummous parts of vegetables*; and *vinous liquors*.

It is found, that various vegetable substances containing the astringent gums, and bitter juices, which possess the property of tanning leather, have the quality of bracing the fibres in the living animal; assisting to the due tone of the nerves; and thence checking the putrescence which would, otherwise, prevail, in consequence of a certain degree of weakness*.

* It is to the effects of the peculiar kind of astringency of the bark, wood, or other parts of vegetables, which possess the tanning property, in giving due tension to the solids, and thence producing the due motion of the fluids, as above-mentioned, that their power of resisting putrescence in living bodies must be ascribed; and not, as was before observed, to any immediate action on the juices themselves, by which that disposition is checked: as would happen on the mixture of the same fluids, in a proper proportion, out of the body. The proportion of the quantity given medicinally, compared to the whole mass of fluids on which it is supposed to act, is far insufficient to produce such an effect: as may easily be ascertained by experiment of the effect on the commixture of proportionable quantities of the same substances out of the body. The observation, that such substances had the property of checking the putrefaction of animal substances out of the living body, to which the name of *antiseptic* has been given, has occasioned, nevertheless, the accounting, by a precipitate judgment, from it, for the effects of those substances in the living body, without a due regard

The Peruvian bark is the principal simple of this kind, which has been hitherto used; and experience has not yet evinced any other to be in all respects an equal substitute for it. The efficacy of this drug in intermitting fevers has been long known: and, more lately, its utility in some contagious disorders, and all others where the weakness and relaxation of the fibres aggravate the effects, is equally ascertained. Nor are there wanting sufficient trials, as was above intimated, to shew, that, what might

be guard to the proportion of quantity; or attention to the real cause of the suspension of the putrescent action in the parts of animals while alive. The mistake of this principle has not only occasioned erroneous speculations, but wrong practice in medicine. A very material instance of which has been, the adding other substances, deemed also antiseptic, to aid the astringent vegetables: which has been practised, as well in the attempts to cure the murrain, as in other cases. For several of the substances ranked in this class have a tendency to weaken the subject; and consequently to promote instead of counteract putrescence.

The vitriolic acid, in its simple state, or prepared in the form called elixir of vitriol, has been most commonly joined to the Peruvian bark, in this view; and rendered it much less effectual: as may be well concluded from the injurious effects it has on digestion, when weak; and its power of diminishing irritability: both which are very opposite to the intention, in which the bark is given. — The physician, who had, by his writings, most propagated this notion, and use of antiseptics, is now convinced, by more mature experience, of the faultiness of such practice; and candidly acknowledges his disapprobation of joining the vitriolic acid to the bark in low and weak habits.

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be well presumed, from analogy, holds good in observation on facts, as to its availing, in like manner, in the murrain: though it has never, as far as appears from any reports made to the public, been used with those advantages, as to the collateral circumstances, which would most have contributed to render it effectual.

There is, nevertheless, a great obstacle to the giving the Peruvian bark alone to the cattle, in such quantities as might be requisite in the murrain. This is the high price of it: which would render the administering it for the time, and in the quantities necessary, a considerable expence: and it is absolutely requisite, to the using any remedies in this disease with benefit to the proprietor of the cattle, that their cost on the whole should be moderate. It has, therefore, with great reason, been thought expedient, to spare a part of the bark; and substitute, for such part, some other cheaper simple, most allied to it in its properties.—The white-willow bark has been selected, by some, for this purpose; and has, indeed, the tanning property in a considerable degree: but there are other simples, which have that in a still greater; and, also, possess at the same time, additional qualities, which materially conduce to the invigorating effects.—The tormentil root is peculiarly adapted to this intention: as it has
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not only the due astringency, but the warming and cordial properties of bitters, and aromatics: whence it may check the profuse diarrhea, which, when it comes in the early period of the disease, so frequently carries off the beasts, by exhausting their strength before nature can perfect a mature crisis. This simple may, moreover, be easily obtained even at the slightest expence: being one of the most common, and general of the herbs, which grow wild in these parts of Europe. It may, therefore, be well substituted for at least one half of the bark, where no early purging comes on; and for three parts in four, where it does: as the quantity of it may then be increased with advantage.—It may be proper, likewise, to add a proportion of some warm aromatic simple, of the kind called carminative: and the caroway-seed is extremely well suited, in all its qualities, to that purpose. This will invigorate the action of the stomachs; which appears evidently languid: the stomachs themselves, as was above observed, participating of the paralysis of the upper parts.

By vinous liquors, which are the other species of invigorating medicines proper in the murrain, is meant any kind of fermented liquors, that contain vinous spirits.—The late-acquired knowledge of the efficacy of this kind of remedy in contagious, and other

fevers, where putrescence prevails, has furnished the means of aiding nature to resist such diseases, when the natural strength could not otherwise support the vital œconomy against the effects of them.—The giving wine, in our country, to the beasts in the murrain, would, however, be impracticable on account of the expence: and, perhaps, good fermented malt liquor is better adapted, on the whole, to the intention than wine. A proper quantity, therefore of ale, that is not too new; or of that kind of malt-liquor, called strong-beer, should be given twice a day: and to render it more cordial, where greater symptoms of weakness appear, a proportion of some *distilled* spirit should be added to it.—The kind called geneva, is the most cheap and easily obtained: and the ingredients, besides the vinous spirit, being terebinthinate essential oils, are by no means improper in this case.

The secondary intention of cure, above-mentioned, by the supply of diet suitable to the disordered state of the digestive faculty in the murrain, may be thus provided for.—The beasts may be fed on hay, so long as it appears to agree with them. Though, as there is always a defect of the saliva, and the lymphous juices of the stomach, as well as a consequential weakness in the digestive ferment, it may be proper to mix some proportion of

green herbage with the dry fodder. But when the hay, or herbage, cannot any longer be digested, as will be indicated by the beasts refusal of it, and their ceasing to chew the cud, it will be requisite to have recourse to such other food, as is either fluid, and consequently does not demand the dilution of the saliva and lymph; or such as is of so divided a texture, and so yielding to maceration, that it may not need the strong action of a digestive ferment to its resolution, or reduction to that state of chyme, which fits it to pass into the smaller intestines.—Milk is the most nutritive of any fluid, which can be administered in this case: and, if its coagulation be prevented by the addition of alkalies, to counter-act any accidental acid in the other stomachs, that might, otherwise, have that effect, it will of course pass forward to the curd-bag: which, from its emptiness in the dead beasts, appears not to have lost its action, as the higher stomachs; but to propel duly the chyme, or digesting matter, into the lower guts.—In order to make a saving of the quantity of the milk; which, if used alone, would be considerable; it may be expedient to add some water, and a proportion of solid food of the nature above prescribed.—The most fit kind of such solid food is corn in a farinous state, that is reduced to meal: which may be of any sort, that is cheapest, and most conveniently to be obtained.

obtained. This will be macerated so as to mix with the fluid given with it, if the digestive ferment be ever so weak; and will pass with it forwards into the small guts, if the action of the stomachs be ever so slight. — By these means, proper alimentary matter will be conveyed into the lower intestines; and there digested: as they and the curd-bag are not, at least in the earlier stages of the disease, so disordered, and rendered incapable of their office, as the three upper stomachs: the default of the action of which will, nevertheless, in this method, be made of much less consequence.

The nutrition of the beasts in the latter stage of the murrain will be thus provided for; notwithstanding the impediments, which the effects of that disease otherwise produce to digestion: and the inanition thence resulting, which conspires powerfully with the other causes of weakness, and putrescence, to render the disease fatal, will be, in a considerable degree, prevented.

The alkalies, which may be used to hinder the coagulation of the milk, given as food to beasts in the murrain, may be a small proportion of sope, or chalk*. — The

* The use of alkalies has been exploded, by some eminent writers, in all cases where a putrescent disposition prevails, from the notion of their promoting it: and some of the most sensible of those, who have treated of the murrain, have adopted the same opinion. But

latter of these may be used more copiously, where a looseness comes on too early, or too profusely: as it will check such an evacuation without the danger of stopping it, in case it be critical.

By a proper use of these medicines and regimen, it may be presumed, on the justest ground of trial and observation, as well as of speculative reasons, that a considerable number of the cattle, which would die of the murrain, if left to the natural course of the disease, would be saved. It is not to be imagined, nevertheless, with the least shadow of reason, that there is any method of cure, which would avail in every instance: the very weak, or disordered habit of part of the

this objection to alkalies is not justly founded: as they have not, when taken in moderate quantities, such an effect in the habit. The proportion of them, given medicinally, is far too small, to have any immediate action of this kind on the whole mass of fluids: and, in their consequence, from the operation they may have in the intestines, they produce often the contrary effect. For, by destroying the acedent ferment, which prevails in cases of weak and disordered digestion, they promote the proper digestive ferment; and prevent that increase of debility, and general injury to the habit, which the faulty digestion would produce.—It may seem a paradox, according to the effects of experiments made on the relative substances out of the body; but it is, nevertheless, absolutely true; that alkalies check, also, the putrid ferment of the digesting matter in the intestines: as is plainly evinced by their removing almost constantly that species of heart-burn, which arises from the putrescence of animal food, in weak and depraved stomachs.

beasts

beasts subjecting them to the violence of the distemper, in a degree beyond the power of those practicable means, that can support their strength. But, if such a number be preserved from destruction, as overballances, on the whole, in any material proportion *, the expence of the treatment of the cattle

* On a moderate computation, the treatment of a beast, conformably to the means of cure above-recommended, would not, on an average, cost the owners of cattle above eight shillings in the course of the disease. So that if, according to the principles above-premised in the note, page 423, it were necessary to practise it on four beasts, in order to save one, the actual expence incurred for each beast, so saved, would not amount to above thirty-two shillings: which is not more than one third of the price of neat cattle, taken one with another, at a time when the disease prevails. But the advantage to the public would be in much greater proportion than merely this gain, from the effect, the saving one half the beasts, that otherwise would die, would have in keeping up the national stock; and preventing the scarcity from becoming greater: the mischiefs of which, when it goes beyond a certain degree, augments in much larger than an equal proportion to the scarcity itself.—To the proprietors of cattle, moreover, the advantage of every beast so saved, would be far beyond the common price of one in other respects equal. For, after the disease has had some duration in any place, the value of the cattle, which have had it, rises very considerably, on account of their future security from the infection.

In the latter part of the time, when it last raged here, a cow, which could be well certified to have had it, was deemed to be worth sixteen pounds, near London; and the same holds good now, as to the price of such a cow, in Holland. This circumstance not only yields an additional motive to the proprietors of cattle, to pursue an efficacious method of cure: but it is pregnant with great advantages to the community. As the recovered

by the method proposed, the proprietors will find an adequate inducement to put it in practice : and the public will, in several different manners, reap great advantage from it, if extensively adopted.

I have for more than one reason omitted, at present, the giving formal prescriptions for the medicines, or rules for the regimen. As there will be a more proper season for it, if the occasion for the practice of them should ever again occur in our country.—The knowledge of the symptoms and appearances, by which, the disease may be distinguished, are, alone, all that is necessary to be generally taught now : but that knowledge, certainly, ought to be diffused as universally as possible.—The explaining, at this time, a method of medicinal treatment, in such a way, as to render it easily practicable by the common owners of cattle, would be rather injurious than beneficial, in its effects to the public. What constitutes the great object of care, and attention, at present, is, the excluding the contagion from our country, by the immediate slaughter of the beasts infected, or exposed to the hazard of being so ; and not the attempt of cure *. Reason, and

cows must here, where a fresh supply cannot be had by land, as on the continent, make the principal dependence for breeding, to keep up the stock ; and for obtaining milk.

* As the means, which ought to be pursued for the national security, according to the present circumstances, in

the legislature both decree that measure :
and, in order, that what is ordained by au-

in case the murrain should break out any-where with us again, are, the killing immediately the cattle infected ; and the preventing the removal of those exposed to be so, or of any thing that can convey the contagion ; the publishing, at present, directions for the cure of the cattle, in so explicit and familiar a way, as might be easily put in practice by the common owners of them, would, probably, have injurious consequences to the public : as it might produce motives to neglect destroying the beasts, under the hopes of saving them by cure.—It is, therefore, more proper, while the disease is confined to one spot only, or to a few with narrow limits, to furnish every assistance to the quick and certain discovery of the disease, if it should be brought over to us, in order to suppress it instantly, by those means, which are ordained by law, than to encourage any endeavours to save such beasts, as are infected with it.—If, after these means of extirpating the contagion have been duly tried, they should be found to have failed of success, so that the infection has been spread over a large extent, or diffused into a great number of places, as happened in the former invasions of our country by it, the case would be quite altered : and the supplying then, as extensively as possible, the best means of saving the cattle by medicinal aid, would be a great benefit to the public ; because the destroying them, under those circumstances, would be very detrimental, instead of advantageous : as it could not possibly produce the intended effect ; but would cooperate with the disease itself, in causing a scarcity of cattle.

The continuance of the orders for destroying the cattle, after the murrain was extensively spread over the country, had a very apparent bad effect the last time it raged here. The visible constant decrease of the cattle, as well from the numbers slaughtered, as from those which died of the distemper ; the great room, which it was found the bounty, offered at large, gave for impositions, and frauds ; and the heavy expence on the public,

thority, respecting this slaughter, and the other regulations for the keeping out, and

lic, in providing for the bounty; afforded therefore, the strongest reasons for retracting the orders for killing the cattle.—This instance, as well as obvious deductions from the subject itself, evinces, it is only when the murrain first breaks out, and the infection is confined to narrow bounds, that the means and regulations at present provisionally ordained by act of parliament, can possibly avail, and be proper. For afterwards, the killing those beasts, which might otherwise recover, would be a palpable loss, not only of so many cattle, but of those that, as we have seen before, are, from their future security against the infection, of far greater value than others: and the restrictions, with regard to the driving and removing the cattle; the prohibitions of fairs and markets for the sale of them, &c. would cause such a defect in the supply of the capital city, as would be attended with very embarrassing and distressful circumstances.

There is another reason, why I have deferred giving a formal prescription for the medicinal treatment of the cattle. It is, that, though I am convinced, from trial and observation, the practice recommended is good in a general view; and I could point rules for the conducting the particulars which would be efficacious; yet there are several circumstances, with respect to which, it is not hitherto ascertained, by a sufficient field of experience, what precise degree, or mode, would be most effectual, and best.—Proper measures are, therefore, taking, for having such trials made in Holland, where a too fair opportunity is at present afforded: and the result of them, when they are completed, will afford the means to lay down hereafter, with more certainty, those rules and directions as to each particular, which may be most effectual, with regard to the cure, and advantageous with regard to the expence.

In the mean time the generals, here presented, may enable any person, versed in medicinal subjects, to give directions for the putting the cattle under the due regimen, if a just occasion should demand it.

stopping

stopping the progress of the infection, may be rendered more effectual, I shall here subjoin a few hints relative to some defects, and errors, in the present plan of measures, which, as they now stand, may prevent it's being effectual to the purpose.

The first, and greatest defect, attending what is ordained by the government for the suppressing the contagion of the murrain, in case it should be brought hither again, is, the general want of due knowledge for discovering the disease early, on its first breaking out; or distinguishing it, with some degree of certainty, in each particular beast, from other disorders incident to cattle.—It is in vain, that private persons should be enjoined by the government to destroy their cattle, and magistrates to compel them to it, and return them a satisfaction, provisionally the infection be actually in the place, if they be wholly ignorant of any certain signs, by which they can distinguish it. Yet this is almost universally the case at present: there being scarcely any, but persons applying to medical speculations; and some few others, who may remember what they observed during the time of its prevailing here formerly; that are, in the least, acquainted with the nature of the disease, or its appearances. Moreover, the far greatest part of those, who may be desirous of acquiring a due information in this matter, are

are almost intirely destitute of the means : as there is no method generally known of gaining any satisfactory intelligence relating to it : and such lights, as might be obtained, if the means were better known, could not be procured occasionally, in case of an alarm in any particular quarter, before the opportunity of their being serviceable was over ; and, either the contagion, if it had been really brought, was propagated too widely to admit of a suppressive remedy ; or a needless expence incurred, by the neighbourhood, if any other disorder of the suspected beasts, had been mistaken for it.— Many important acts are, by the late statute, required to be done by the magistrates, inspectors, &c. conditionally, that they shall *believe* the distemper be in any suspected place, or within a certain distance of it. But on what, shall they ground such a belief on a subject, of which they have no means of judging ? or who shall be qualified to certify sufficient matter of evidence to them, when every body around them are equally in the dark with themselves, as to those principles, which furnish such means ?—This seems to be a difficulty, in the due execution of the orders of council for destroying the suspected cattle, and laying restrictions on the removal of those probably exposed to the contagion, which renders their operation extremely uncertain ; and may cause great inconveniences

inconveniences from consciencious and zealous attempts to inforce them, where the facts, on which the right determination of measures wholly depends, are so easily to be mistaken.——The method to remove this difficulty is suggested by the very nature of the subject itself.——It is, obviously, the providing the proper means of information of the characteristic signs of this disease; and circulating the intelligence of them, as generally as of the orders of council themselves: in the doing which, the following manner seems most easy and effectual, according to the present state of things.

A brief account of the most discernible and peculiar symptoms of the disease, and of the appearances in the inward parts of the beasts which die of it, should be procured. This account should be drawn up, in the most clear and simple manner; and expressed in the most plain and common language, divested of all terms of art, and accommodated to persons of ordinary capacity. It should then be transmitted to every parish, and disposed of there, in such manner, that all the inhabitants may be apprized of, and have easy means of recourse to it, whenever they may have occasion: and more particularly those, who are officially concerned in the execution of the orders of council.—In order to do this most conveniently, it may be proper

proper to follow, in some measure, the same method, which is taken to promulgate the late act of parliament and the orders of council.—It is ordained by that act, a printed copy of the same, together with any orders of council made in pursuance of it, shall be provided by the church-wardens, &c. of every parish, with intent, that they may be read, by the minister, the next Sunday after the receipt of them; and afterwards, on one such Sunday in every calendar month, as he shall think proper: and, also, that they may be kept by him in order to his permitting every person, residing in his parish, to read the same, during the time, the respective orders of council may be in force. Now it would be expedient to join a printed copy of the account of the signs of the disease, with those of the act of parliament, and orders of council, that it may be always ready to be consulted, along with them, or separately, by all persons, who may have any need of such information.

It would, likewise, be very expedient, in order to the rendering more general a due knowledge of this disease, to have a copy of the account of the signs of it, being printed on an open sheet of paper, hung up in a proper frame in the market-house, town-house, or any other public building, in each parish, where the people may constantly have recourse to it, without troubling the minister:

ter: which would induce them to take more readily the pains to obtain the requisite information from it. Another copy should be always in the possession of every magistrate, inspector, or other person, who has any official concern in the execution of the orders of council, that they may have the necessary means at hand, of enabling them to judge, how far, in any suspicious case, there is just ground to conclude the actual presence of the disease.

As the greater, or less success of the injunctions, or regulations ordained by the government for the preventing the bringing into our country the contagion of the murrain, or for suppressing it, if brought, depends on their being more or less generally known, it seems, that the present means of publication of them are defective: as it is certain, that, by such means, only a small part of those, whose conformity to them is requisite to the end, can be possibly thence apprized of them. — A proclamation of all orders of council, respecting the disease, is inserted in the Gazette; and the last act of parliament directs them, as above-mentioned, to be read one Sunday of every month in the parish-church, or other place of public devotion. — But few of the common people, and perhaps even the magistrates, &c. constantly read the Gazette in the country: and there are many parishes, into which it never comes at all. —

Numbers

Numbers of persons, being of other sects of religion, do not go to the parish-church at any time: and others are very liable to be absent on the particular days when these orders are read. The church-wardens, or other officers, moreover, who are to provide the copies of them, not having an opportunity of seeing the proclamations in the Gazette, are, sometimes intirely uninformed of them: and, therefore, do not provide the printed copies of them, as directed.—For these, and other reasons, the reading them duly in the church is often neglected: and, consequently, the whole, or a great number in every parish, are left ignorant of what is ordained.—It is necessary hence, that some more effectual method of publishing the contents of the proclamation should be persued: and it would be, therefore, right, that the contents of them should be printed in the manner before proposed for the account of the signs of the disease, and hung, up with it, in the most public place in every parish: which could not fail to make them much more generally and perfectly known than they can be at present. This should be, under the circumstances now subsisting, particularly attended to with regard to the seaports, and parishes adjacent to them, of the eastern and southern coasts of the island; where the danger is, by far, the greatest, of the distemper's being now conveyed to us from
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the shores of the opposite countries where it rages with great violence.—To obtain the greatest security, it would be expedient, that the printed copies of both these kinds should be actually sent to every such parish, to be disposed of as above advised: and the procurement of them not solely intrusted to the church-wardens, by whose ignorance of the proclamations, or inadvertence, it will be frequently omitted.—Or, at least, notices of the orders of council, &c. and the injunctions on the church-wardens to procure them, on each occasion, should be advertised in all the principal news-papers, as well in town as country.—In order that the whole of this should be duly executed, it seems further requisite, that some proper officer should be appointed, by the crown; to take the charge of doing it on him: and to see, that what is ordained may be duly complied with.

Some measures of the kind here pointed out are indispensibly necessary, to give us any hopes of the good effects of the ordinances of the late acts of parliament, respecting the prevention of the murrain: which can yield but little safety from it, unless generally complied with. For, if from want of due conformity to them, the disease should find its way into this island, in any one place; and spread itself thence widely to others, as may, in such case quickly happen;

happen ; it will not be of the least avail, that the strictest observance of them has been practised, in a thousand others : since the dreaded mischief may as well diffuse itself, with all its calamitous consequences, over the whole of our country, from one single original source, as from any multiplicity whatever.

There seems to be a very material error in the regulation, ordained in the late acts, respecting the prevention of the removal of such cattle, as may possibly have been exposed to be infected by the murrain, or to contract contagious matter on their skins, from being near other beasts seized with the disease : which error may be productive of great inconveniences, if the regulation be duly observed ; or raise motives in those, whom it concerns, for not paying due obedience to the ordinance. This is the too great length of time required, when the infection is supposed to be in the neighbourhood, for the purchasers of cattle to keep them before they sell them again. Forty days is the time prescribed : and when all the facts, from which, the determination of the proper period must be deduced, are duly weighed, it will appear to be at least two thirds longer than is necessary.—The only reason that can be assigned for the expedience of a restriction, as to the time of selling cattle, in these cases, is, that the seller
may

may be able to give such a certificate to the buyer, as affords the best assurance possible, that the beast has not taken the infection; nor is likely to convey the contagion by any infectious matter, adhering to its skin, though not affecting itself, from any diseased beasts it may have approached, to others which may come near it. This period of forty days is allotted: because such a certificate could not be made by the owner, unless the beast had been long enough in his possession, to shew it had not been infected before it came into his hands; and to afford time for the infectious matter, if any had been contracted by its skin, to have lost its virtue, or been worn off: and because it was presumed, a less space of time would not have been fully sufficient for this effect. — As to what respects the having actually received infection, forty days possession is much longer than is needful to manifest, whether, or no, such infection was taken by the beast before it came into the seller's hands: since the symptoms would have shewn themselves; and the beast would have died of, or recovered from the disease long before half that time was expired *. — As to what

* It appears, from the experiments made at Utrecht; in 1769, as above-mentioned; and from others, of the inoculation of cattle for the murrain; that the longest period, in the case of beasts so treated, betwixt their receiving the infection and their death, was not more

respects the contagious matter, that may be co tracted by the skin of the beast from others infected, the time, in which such matter may lose its contagious power, or the skin become free from it, cannot possibly be ascertained ; and there is reason to believe it might go much beyond forty days : but there are easy means to be employed of taking away the hazard of conveying the disease to other beasts in that way, with far greater certainty than can result from the waiting even a much longer space than forty days without the use of such means.

The time in which the symptoms appear to come on, in the murrain, after the taking the

than fourteen days.—The observations on the same period, with relation to such beasts, as have taken the disease from others, without inoculation, where it could be ascertained by the known time of their coming within the reach of the infection, shew the longest extent of it in such cases, to be about seventeen days. But this must be understood to be according to the course of the disease in Holland. For in our country, the death of the beasts, taking the disease naturally, was found to happen almost always within twelve or thirteen days after the infection : the crisis or turn of it, as we remarked before, being about four or five days earlier here than in the United Provinces. It must be comprehended, also, that this period of the death regards beasts, which are carried off by the murrain, considered as an acute disease : for where they die, after their recovery from the proper symptoms of the distemper, of ulcers, or abscesses in the viscera, produced by it, no regular period can be fixed on : as those accidents, or their consequences, differ in every subject where they happen.

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infection, is, as we have above observed, almost generally on or before the fifth day *. But as there may be, though rarely, a variation, that requires some latitude, we may rate the longest time to be the seventh day. In a very few beasts, however, which have the disease, in the most mild and gentle manner, we may, also allow time for the aggravation of the symptoms, till they become strong enough to be so clearly perceptible, as to leave no

* There is a remarkable uniformity in the operation of the contagion of the murrain, as to the time it produces sensible effects, when communicated by exterior infection. — In the above-mentioned experiment, made at Utrecht, twelve cows were put to six others, that were inoculated ; and kept with them, in a confined place, from the time of inoculation. The twelve were all seized with a cough and gnashing of their teeth, the seventh day after the inoculation of the six ; and did not exhibit the least difference, in the period of their being affected by the infection ; which may be concluded to have been taken five days before : as, at that time, though it was but the second day after the operation, febrile symptoms began to appear in some of those inoculated : one of which, indeed, was so weak on the third day, that she fell down ; and had not strength to rise again. The same uniformity is not, in the least, found in the inoculated beasts : but in most of them, the symptoms come on with much more celerity, and violence, than in those, which have the disease by casual infection. — Many other facts confirm this observation of the almost constant equality of time, in which the visible effects are produced in the cattle, which have the murrain by natural means ; and they leave us no room to suspect, the infection ever lurks, after it is taken, without revealing itself, more than six or seven days, even where its action is the weakest.

room for doubt; and suppose, in those instances, they may not be very observable till the tenth day. But this is the utmost concession, as to the extension of the time in which the infection can lie concealed without sensible effects, that facts will admit us to make: and, if no appearances of the disease be found at, or before that period, it may be very safely concluded, the beast had not taken the infection before the commencement of such time.—If, nevertheless, we should go somewhat further, to satisfy all scruples, as to the inaccuracy of these observations; and stretch our caution to the utmost that can be deemed reasonable; the keeping the beasts twelve days, after they are purchased, is fully sufficient to determine with the most positive certainty, that they were not infected before such purchase.—There cannot be the least reason, therefore, to keep the beasts longer than twelve days before they are sold, in order to avoid the hazard of their having received the infection before they came into the hands of the owner.

The other more specious reason, for restraining the sale of cattle during so long a period, has not, at the bottom, a more solid foundation in the reality of facts than the preceding.—No precise limits can be assigned to the time, that beasts, having the infectious matter of the murrain lodged on
their

their skins, in consequence of having come near beasts seized with disease, may communicate it, by that means, to others.

The contagious matter will preserve its infecting quality for a long space of time: as we have reason to conclude, as well from facts respecting the transmission of it into distant countries, and some experiments regarding inoculation with it, as from its analogy to the variolous matter of the small-pox; which retains its virulent power for many months. There is room to conclude, that the contagion of the murrain has been conveyed by the raw hides of beasts, in particular, to places, where it has taken effect at a considerable space of time after its production: and, if it can be so preserved in the skins of dead beasts, why not in the hair of those, which are living? It must be granted, indeed, that in the skins of the living, it is more exposed to be accidentally carried off, than in those of the dead: but there is no certainty, nevertheless, that it will be intirely cleansed away thus under a long time. Even forty days, therefore, do not give a security against the danger of a conveyance of the infection that way, where beasts are removed from the diseased cattle to the sound.—I am aware, it will be advanced, in contradiction to this, that the skin of a living beast being exposed to the air, the contagion will be dissipated in the

forty days; and not preserved, as in the parts of the hides of dead beasts, to which the air may not have had a like access. But I deny the truth of the principle, on which this conclusion depends. — It has, I grant, been a prevailing notion, borrowed from antient writers, and delivered down by those of succeeding times without any examination of the relative facts, that the contagion of the febrile diseases resided in volatile effluvia, which exhaled in the air; and flew off in a short time from bodies that had received them. There is not, however, in reality a greater error subsisting than this established notion. Many experiments on the variolous matter have evinced the contrary, by shewing, that it will keep its virtue, and serve for the purposes of inoculation for a great length of time, though exposed to the air: provided it be defended from excessive cold, and such moisture as would render it mouldy. A less extensive field of observation, but sufficient to verify the principle, confirms to us, that the analogy holds good, as to this point, on the contagious matter of the murrain; and others of a similar nature.—If, therefore, the virulent matter will not, with certainty, be taken off by accidental means, from the skins of beasts; nor lose its infecting power, by exposure to the air, under a long time; the preventing, for forty days, the communications of cattle, whose

whose skins may have some share of it on them, with any others, is not a full security against their conveying the infection; if, afterwards, they be suffered to mix with the sound.—The establishment of this species of quarantine, or prohibition of removal for forty days, is, consequently, insufficient to the end in that view. But, beside the uncertainty of its effects, and the great inconveniences to particulars it may produce, it is less proper, and expedient in this intention; because there is another method, by which the same end may be answered in a much more easy and effectual manner. The method I mean, is, the cleansing the beasts by artificial means: which should always be practised, where there is the least danger of their transmitting the contagion, from those infected to the sound, without having taken the disease themselves. This may be commodiously and efficaciously performed by scouring the skins of the suspected beasts, by a proper brush, with fine sand and water; and afterwards thoroughly washing off the remainder of what may adhere, by water and a mop. By these means, the skin of any beast will be more perfectly freed from infectious matter, that was lodged in it, than by the accidental wearing off in a very long space of time: and, if it be duly executed, there can be no reason to put the sale of cattle under any restriction on this score.—

The practice of it should, however, be strictly enjoined by authority, if the time of restriction of sale be reduced as proposed; and the performance of it should be, also, made a part of the matter of certification.

As twelve days appear, from the above-given reasons, to be fully sufficient, to shew, that beasts have not received the infection before; and as the keeping them much longer is not so effectual a means of taking away the hazard of their transmitting the disease by contagious matter adhering to their skin, as artificial cleansing; the term of forty days restriction from sale ought most evidently to be changed to that of twelve days: which saves more than two thirds of the time.— This shortening the term will be found a matter of very great moment, if ever the occasion for such a restriction shall again offer. The great inconveniences, and embarrassments, that would attend the obligation to keep cattle, however detrimentally to the owner for so long a time as forty days would, if it were largely extended, besides the injuring individuals, conduce, along with the other necessary regulations respecting the removal of cattle, to the causing a scarcity of them in the London markets, and others which are supplied from distant places.— But what is of still greater consequence, the loss and trouble, that would result from it to individuals in some cases, would furnish
such

such motives for a non-compliance with the injunction, as would, in all probability, defeat the intention of it. It, therefore, highly merits the consideration of those, on whom the direction of this matter depends, to weigh well the premises; for a few failures of obedience to the orders of council, respecting this restriction, may render them wholly ineffectual *. There is no maxim more true, than that a law of this kind

* It may be speciously said, that, in a case, of so much moment, as the prevention of the murrain, the interest of particulars must give way to the good of the public: that it is best to err on the safe side, by taking a full scope of time, which has been deemed forty days, to render the matter intirely clear: and that, if the cleansing be a further security, it should be added to the restriction of sale for that term. This way of reasoning must be allowed to be right, as to the general principles; and ought to be adopted, where the facts give just occasion for it: but it fails, in that point, to be applicable to the present case. The extending the length of time of the restriction, so much as forty days, does not render the effect of the prohibition more certain, but evidently the contrary.—It is shewn above, that if the cleansing be put in practice along with it, twelve days will be as effectual as forty; and there is a great probability, when the time is not required to be longer, it may be complied with: there being few cases, where it would then be considerably detrimental to the owners of the cattle. Whereas there is the strongest reason to apprehend, the longer term would not be generally complied with: and, therefore, the ordaining it must counteract its own purpose; as the security proposed from it wholly depends on a general conformity to it.—When obedience to any matter ordained is enforced by a penalty, such penalty will ever fail of its full effect, when the gain accruing

should be void of every thing strongly repugnant to its own operation; or it will prove a dead letter.

To evince more forcibly the extreme great consequence of guarding against the introduction of the murrain into our country, I will here subjoin an account of its late effects in the United Provinces; whence the deplorable havock it makes there, will appear in the most striking manner.—The source of the information respecting the

accruing from disobedience is more than equivalent to the risk of the forfeiture: as we daily see in the great multiplicity of contraband trade. But this principle must hold good still more strongly here, where numbers of persons are unavoidably subject to loss without a disobedience, than where, as in the case of smuggling, the occasion of it arises only from a voluntary pursuit of profit. The obliging people to keep their cattle so long as forty days, when the injunction suddenly and unexpectedly takes place, in cases when they are not provided with fodder to maintain them, nor possibly may be able to procure it without the most distressful difficulties; or where they may lie under a necessity of selling the beasts to raise money they instantly want; will of course create temptations to risk the penalty, that can scarcely be withstood by the weaker part of those, who may lie under these circumstances. Whence it is both against reason, and observation, to form expectations of a general conformity to such an injunction. But if the chance of the loss, and inconvenience, that may casually attend the keeping the cattle, be almost wholly taken away, by reducing the forty to only twelve days, the motives will be proportionably removed for running the hazard of incurring the forfeiture, by a non compliance with what is required: and there is just ground to hope, that the regulation would be then fully effectual.

facts

facts I shall advance, is the registered lists * of the cattle in the South, and North divisions of Holland; which I shall incorporate: and these provinces taken together are nearly equal to one half of the whole United Provinces. — In order to give this account in the most clear manner, consistent with brevity, I will enumerate all the particulars of the state of the cattle for the nine months preceding the 1st of July last: because they are completely exhibited in the registers during that term. To this, I will annex the total numbers of those that died, and recovered in one year; commencing the 1st of April, 1769; and, also, the number which died, and recovered, in each of the three succeeding months: as this latter detail leads to some as well curious, as useful conclusions.

Persons keeping cattle in South-			
Holland, and North-Holland,			
during the term of nine months,			
commencing the 1st of Octo-			
ber, 1769,	-	-	- 17379

* The copies of these Lists did not come to my hands till after most of the foregoing part of this Dissertation was printed: otherwise, I should have made use of the contents of them in support of several matters, I have advanced there: which, the inferences to be drawn from them greatly tend to confirm.

Cattle

Cattle in the possession of those persons during that term : . . . -				224999
—	Infected with the murrain, -	141273		
—	Died of the murrain : -	98995		
—	Recovered after taking the infection : * -	39613		
—	Escaped the infection : -	77850		
—	Died of other diseases and casualties : -	6488		
—	Remained ill of the murrain at the end of the term : -	2053		

Cattle infected in the term of a year, commencing the 1st of April, 1769 : -				210819
—	Died of the disease during that term : -	159128		
—	Recovered in that term : -	61691		

* It may be inferred from this account, that considerably more than half of all the cattle in the United Provinces took the infection of the murrain in nine months: and that almost two-thirds of those, which were infected, died.—The number both of those which caught the disease, and of those which were carried off by it, is proportionably far greater than was found here, while the disease raged most; and even than has been usually known in Holland: at least one half of the infected having generally recovered. This evinces the present excess of power in the predisponent cause, or disposition of the cattle to be affected; and verifies by glaring facts, what I ventured to assert, relating to it, from theoretic reasons, in the foregoing part of this Dissertation, which was printed some months ago before I had any particular information respecting these facts: and, indeed, before the report of them could be made, and registered.

Cattle

Cattle infected in the summer season of that term; commencing the 1st of April, and ter- minating the 30th of Sep- tember, 1769 :	-	-	86423
— Died in the summer season :	-	-	63281
— Recovered in the summer season :	-	-	32142
Cattle infected in the winter sea- son * : commencing the 1st of October, 1769; and terminating the 30th of April, 1770.	-	-	134696

* The number of cattle infected in the winter is, in this account, above two-fifths more than in the summer. The reverse of which appears, with respect to the plague, in the Eastern-countries: where the contagion of it, for the most part, ceases, or at least greatly abates in that season. But the principle, whence this seemingly great variation arises, does not, nevertheless, lie in the nature of the diseases, nor even in that of the predisponent cause of infection in the subjects, which is in fact the same in both; but in the local difference of circumstances with respect to the production of that cause. It is the weakness of the subject, in both cases, that constitutes the susceptibility of infection; and that weakness is induced in different seasons from each other, by a diversity in the climate, and other circumstances, attending the places, in which the respective disorders, as here compared, prevail.

In those Eastern countries, where the excess of temperature lies in the heat of the summer, mankind, the subject of the plague, are in a too relaxed state, and the juices so putrescent in many individuals, as to render them much weaker than in the winter, which is there mild and salutary. In the United Provinces, on the contrary,

— Died in the winter season : -	95947
— Recovered in the winter season : - - - -	38749

trary, the excess is in the cold of winter : which, being attended with great moisture in the air, makes the cattle, the subject of the murrain, much weaker than in summer : to which the housing them, as is there practised from necessity during that season, much contributes. This increased violence of it in winter, and remission in summer, did not subsist here while the disease prevailed in our country, in any proportion to what it now does in Holland : the less damp state of the air, and the keeping the cattle more out in the fields, having prevented them from being weakened, by the inclemency of the winter, as there. On the contrary, this was so far from being the case, that Dr. Legard says, “ This disease being a contagion of the pestilential kind, is susceptible at all times and seasons. In autumn and *summer* it will rage *most* : in spring and *winter* least, according to the alterations commonly happening in those seasons.” He carried it much too far, as is evident by the facts here exhibited, in saying generally *the disease will rage most in summer* and least in winter : but he spoke from theory only. For supposing, as he intimates, the murrain to be analogous to the plague, he concludes the same effects would always attend the contagion of both, without considering the predisponent cause, on which the operation of it depends, may vary in different places.

A more close inquiry, perhaps, into the course of the distemper here, would have prevented this error.—The whole, however, concurs to demonstrate, there is no intrinsic difference, in this point, betwixt the contagion of the plague, and that of the murrain ; but that the variation of the effect of them depends on the variation of circumstances respecting the predisponent cause in different places.

Cattle infected in the term of three months, preceding July

1770 *:	-	-	-	3912
— Died in that term:	-	-	-	3048
— Recovered in that term:	-	-	-	864
— Died in April of that term:	-	-	-	1254

* The number of cattle infected in these three months is only in the proportion of about an eighteenth part of those in the winter season: and yet of them near four-fifths died. These beasts may, therefore, be presumed to be such as laboured under some constitutional, or other peculiar cause of weakness, from which the favourable temperature of the weather could not free them.—In June, the number infected was not one sixth part of that of either of the two preceding months; nor, consequently in the proportion of so much, as one hundredth part of those of the winter season: the number which died were, nevertheless, still more, in proportion, than in the two preceding months.—This evinces that the heat of the weather, though favourable to the beasts in health, as to the preserving them from infection, was injurious to those whose weakness made them take it: which may be easily accounted for, from the greater tendency, that the animal fluids have to putrify in hot seasons. Whence it may be inferred, that it is not a greater disposition in the humours to putrify, independant of weakness, which causes the susceptibility of infection, but weakness only: and that, therefore, unless the degree of this disposition be such as induces weakness, it does not contribute to the reception of the contagion though to its stronger operation when received. This confirms what I have above advanced, that putrescence has not primarily any concern in the cause of the murrain, but in the consequences of it: as, being either before subsisting or produced by the operation of the infection, it aggravates the fatal effects as a secondary cause.

Cattle

_____	in May:	-	-	-	1325
_____	in June:	-	-	-	469
_____	Recovered in April of that				
	term:	-	-	-	452
_____	in May:	-	-	-	303
_____	in June:	-	-	-	109

It appears, from the finance accounts, that the province of Holland, if the two divisions of North and South, from the separate lists of which, this account is formed, be taken together, may, as was before intimated, be considered as one half of the Seven United Provinces, at least with respect to the cattle. So that, if we admit the supposition, for which there is good ground, that the ravage made by the murrain, was nearly the same in the other Six Provinces, as in that, we may conclude, that the loss of cattle destroyed by it, in the whole, was not less, in one year, commencing April 1st, 1769, and ending March 31st, 1770, than three hundred, and eighteen thousand beasts. And there is little room to hope from appearances, that the disease will be less violent this year than it was the last.

If we reflect, that this immense loss is, in some degree, annual at present in the United Provinces, we cannot but deem the being afflicted with the murrain, a most deplorable

deplorable calamity: and this uncommonly strong prevalence of the contagion there, ought to be equally an object of our dread, as of our compassion. It shews a very great predisposition in the cattle to be affected by this disease; and that predisposition is owing to causes, which, from their very nature, are extended over all the neighbouring countries, in some proportion: as is further manifested, by the actual progress, the contagion is now making in parts, where there is no endemic or local cause, in the cattle, of the susceptibility of the infection. We see, by his Majesty's late proclamations, that it has passed into Flanders; and is now spreading thence to the adjacent countries of France *,

* This rapid progress of the contagion, and extending of its effects into places, where it spontaneously extinguished a considerable number of years ago, and has never, before revived, since, is, together with the great epidemic prevalence of the disease in Holland, displayed in the above-given account, a strong confirmation of the truth of the principles, whence I formed a judgment *à priori* of the present susceptibility of the infection in the cattle throughout all these parts of Europe. As my prediction, relating to the consequences of it, given in the foregoing part of this Dissertation, is verified by these facts, which have happened since the printing it, the certainty of those principles ought to excite the greatest apprehension of our danger from them; and the most powerful motives for our very earnest attention and care to guard against this menacing evil.

where there are no unfavourable circumstances, as in the United Provinces, for the beasts to be more particularly subject to the disease ; unless, in common with those of the neighbouring countries, from the accidental influence of bad seasons. This cause subsists alike with us : and we are equally exposed to all the mischievous consequences of the contagion, if it be introduced into our island : which, without the greatest care in the exercise of due preventive means, is extremely liable to happen from the proximity of the places where the infection now prevails, conspiring with the susceptibility of it, that attends the cattle at this period. — It, therefore, highly behoves every individual to exert his utmost endeavours, according to his situation, to avert this impending danger of one of the most heavy calamities that can befall any European country : and more especially our own ; where the luxurious habits of the common people, the difficulty of obtaining a supply of cattle from other places, and the high prices of the necessaries of life, would render the effects of a scarcity of horned beasts, and consequently all other provisions, peculiarly grievous and intolerable. R. D.

END OF VOLUME THE SECOND.

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